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FM 101-10

DEPARTMENT OF THE ARMY FIELD MANUAL

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STAFF OFFICERS' FIELD MANUAL ORGANIZATION TECHNICAL AND LOGISTICAL DATA

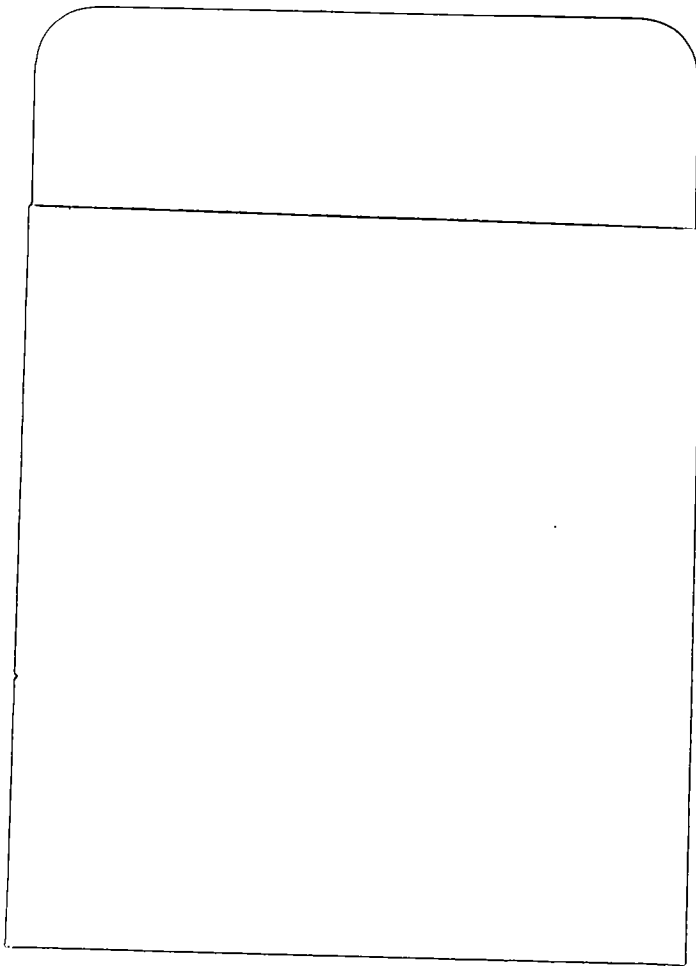
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DEPARTMENT OF THE ARMY

SEPTEMBER 1956





FIELD MANUAL

STAFF OFFICERS' FIELD MANUAL

ORGANIZATION, TECHNICAL, AND LOGISTICAL DATA

FM 101-10

CHANGES No. 2

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C., 3 January 1958

FM 101-10, 6 September 1956, is changed as follows:

Remove pages 7, 8, 9, and 10 and substitute revised pages 7, 8, and 10 and reprinted page 9.

[AG 320 (12 Dec 57)]

By Order of *Wilber M. Brucker*, Secretary of the Army:MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

HERBERT M. JONES,
Major General, United States Army,
The Adjutant General.

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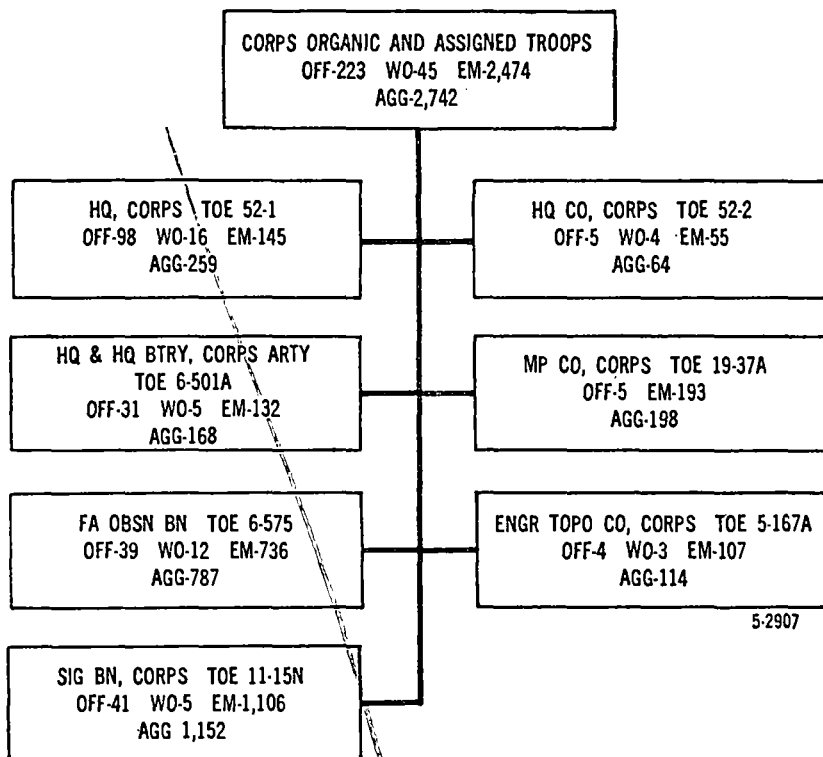
NG: State AG; units—same as Active Army.

USAR: Same as Active Army.

For explanation of abbreviations used, see AR 320-50.

515 c 2

b. Diagram of Corps, Organic and Assigned Troops.



5. Task Force

A task force consists of those units (command, intelligence, combat, and service) necessary to carry out certain planned operations (tasks). It has no fixed organization and may be organized from Army, Navy, or Air Force units, or it may be a combination of any two or of all three. A task force designed for one operation might be especially strong in armored units; in another, amphibious units might be predominant.

6. Logistical Commands

a. *General.* The logistical command is a highly flexible organization consisting of a headquarters and headquarters company and the requisite force of service units organized to execute a specific administrative or logistical support mission augmented by tactical units if required for rear area defense. The logistical command is normally assigned to the communications zone, but may be assigned or attached to an army or an independent task force for the purpose of operating a service command in support thereof.

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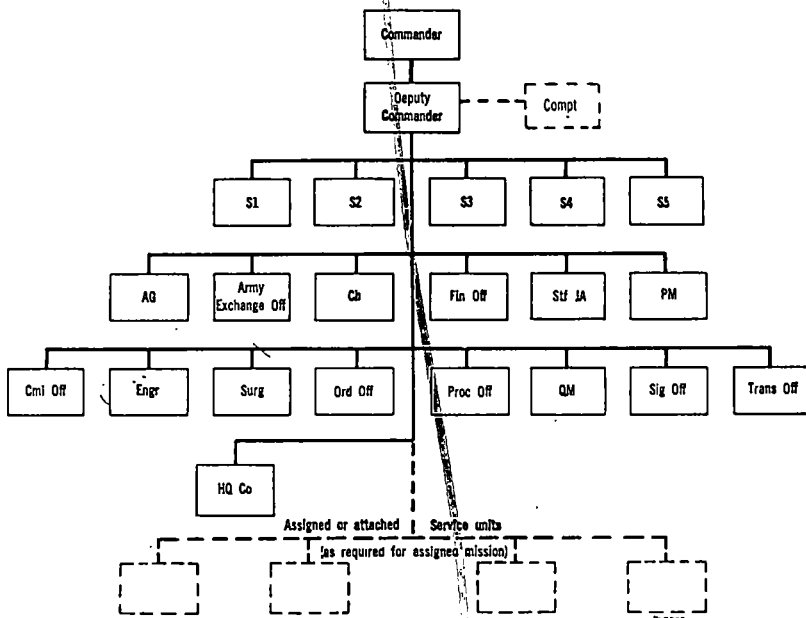
b. Headquarters, Logistical Command. A headquarters and headquarters company is organic to the logistical command. The organization of these headquarters is flexible and should be tailored to fit the mission assigned. The staff organization will be designed to fit the responsibilities of the command.

c. Service Units. Service units of the required numbers and types are assigned or attached as necessary to accomplish the assigned mission. Nondivisional logistical units will be standard or cellular TOE technical service units organized into optimum sized major units for specific tasks.

d. TOE Type Headquarters. At the present time, there are three types of TOE headquarters and headquarters company, logistical commands (Types A, B, and C). These headquarters are available to provide the nuclei for organizing logistical commands. These headquarters are designed to command and control service forces as indicated below:

(1) *Logistical Command Type A (TOE 54-1 and 54-2).*

(a) *Organizational chart for headquarters, logistical command A.*



(b) *Capabilities.*

1. When provided with appropriate technical and other service forces, to furnish army or communications zone type support to a combat force of approximately 30,000 men by—
 - (a) Operating a service command in support of an army, or
 - (b) Operating a small section (advance, intermediate, or base) of a communications zone, or
 - (c) Operating a major territorial subdivision of one of the above, such as a base, a district, or an area.

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2. When provided with appropriate technical and other service forces, administration and rehabilitation of an area in which civil means are inadequate because of natural disaster or enemy action.

(c) *Strength.*

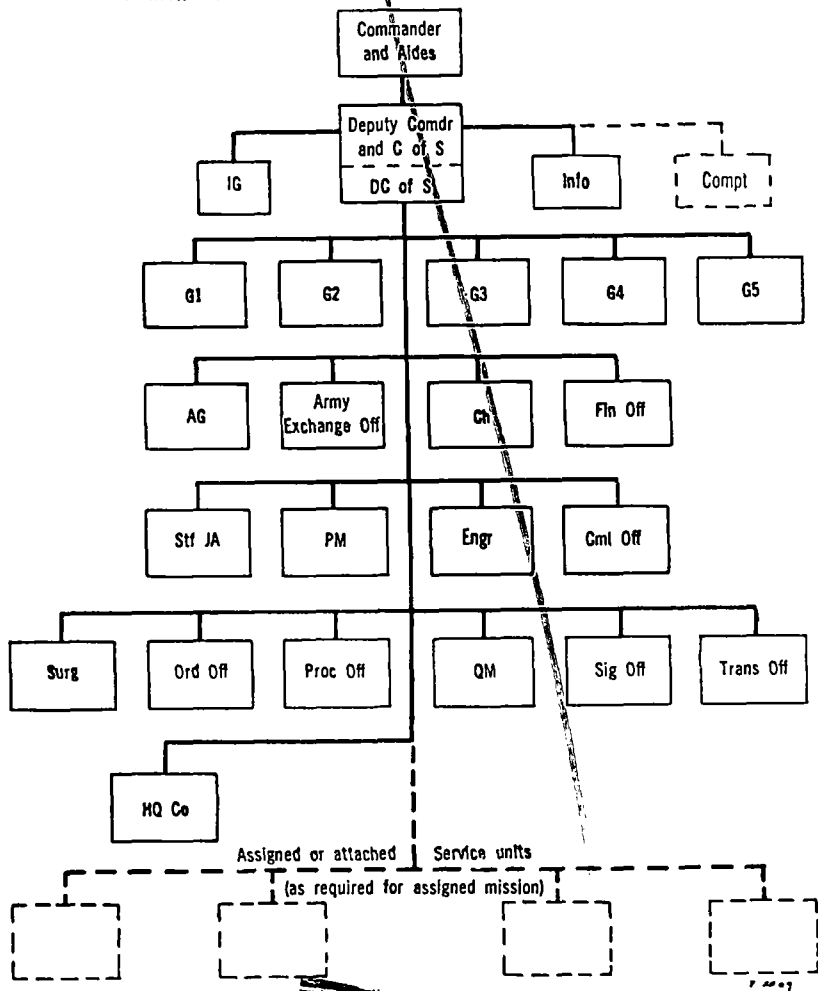
1. Headquarters, and headquarters company, logistical command A: Off 55 ANC 1 WO 4 EM 122 Agg 182.
2. Logistical command A: Agg 182 plus assigned or attached technical and other service forces (9,000 to 15,000).

(d) *Basis of allocation.* One per supported force of approximately 30,000 troops when required to provide administrative support; or 1 per separate administrative or logistical mission, as required.

(e) *Mobility.* Commensurate with the mission and the force being supported.

(2) *Logistical Command Type B (TOE 54-101 and 54-102).*

(a) *Organizational chart for headquarters, logistical command B.*



515C ✓

(b) Capabilities.

1. When provided with appropriate technical and other service forces, to provide communications zone type support to a combat force of approximately 100,000 men by—
 - (a) Operating a small section (advance, intermediate, or base) of a communications zone, or
 - (b) Operating a major territorial subdivision of one of the above, such as a base, a district, or an area, or
 - (c) Operating a service command in support of a task force.
2. When provided with appropriate technical and other service forces, administration and rehabilitation of an area in which civil means are inadequate because of natural disaster or enemy action.

(c) Strength.

1. Headquarters, and headquarters company, logistical command B: Off 117 ANC 1 WO 17 EM 222 Agg 357.
2. Logistical command B: Agg 357 plus assigned or attached technical and other service forces (35,000 to 60,000).

(d) Basis of allocation. One per supported force of approximately 100,000 troops when required to provide administrative support; or 1 per separate administrative or logistical mission, as required.*(e) Mobility.* Commensurate with the mission and the force being supported.*(3) Logistical Command Type C (TOE 54-201 and 54-202).*

FIELD MANUAL

STAFF OFFICERS' FIELD MANUAL
ORGANIZATION, TECHNICAL, AND LOGISTICAL DATA

FM 101-10

CHANGES No. 1

HEADQUARTERS,

DEPARTMENT OF THE ARMY

WASHINGTON 25, D. C., 27 August 1957

✓ FM 101-10, 6 September 1956, is changed as follows:

✓ 1. Remove pages 7, 8, 9, and 10 and substitute revised pages 7, 8, 9, and 10; add new pages 10.1 and 10.2.

✓ 2. Remove pages 93 and 94 and substitute revised page 93, and page 94.

[AG 320 (20 Jun 57)]

By Order of *Wilber M. Brucker*, Secretary of the Army:MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

HERBERT M. JONES,
Major General, United States Army,
The Adjutant General.

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Bn
USATO
Ft & CampsUSMA
CGSO
ARWC
Br Svc Sch
PMST Sr Div Units
PMST Jr Div Units
PMST Mil Sch Div Units
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Sup Sec, Gen Depots
Depots
AH
RTO
Trans Terminal Comd
PG
Arsenals
Mil Dist
MAAG
Mil Mls
ARMA

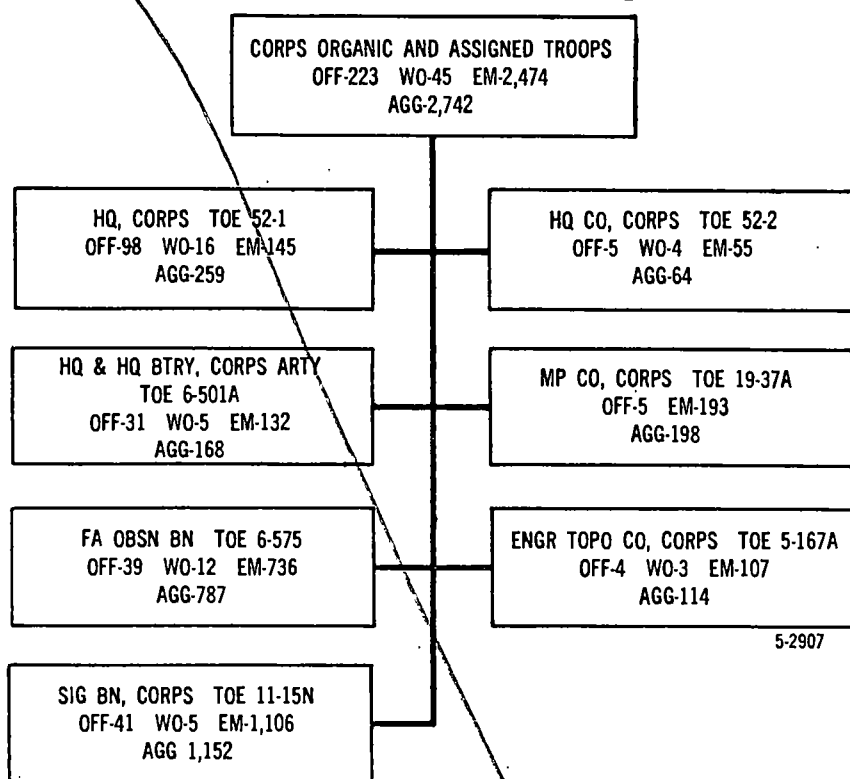
NG: State AG; units—same as Active Army.

USAR: Same as Active Army.

For explanation of abbreviations used, see AR 320-50.

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b. Diagram of Corps, Organic and Assigned Troops.



5. Task Force

A task force consists of those units (command, intelligence, combat, and service) necessary to carry out certain planned operations (tasks). It has no fixed organization and may be organized from Army, Navy, or Air Force units, or it may be a combination of any two or of all three. A task force designed for one operation might be especially strong in armored units; in another, amphibious units might be predominant.

6. Logistical Commands

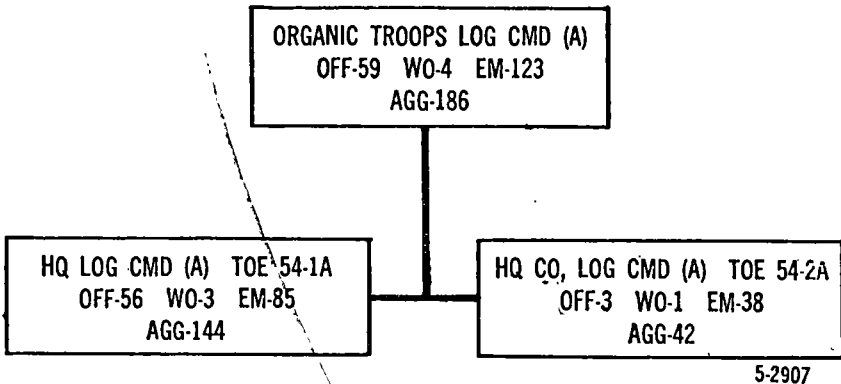
a. General. The logistical command is a flexible administrative headquarters organized to provide logistical support to field armies or smaller units acting independently. The logistical command is normally assigned to the communications zone, but initially may be assigned to an army or an independent task force for the purpose of operating a service command. A headquarters and a headquarters company are organic to the logistical command; additional units are assigned or attached as necessary to accomplish the assigned mission. There are three types of logistical commands, each of which has the

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requisite capabilities for the support of operations of a given size and scope.

b. Logistical Command (A).

(1) Diagram of Logistical Command (A) Organic Troops.



(2) Capabilities.

(a) When provided with appropriate service forces, to furnish army and communications zone support to a combat force of approximately 30,000 men (comparable to a reinforced division) by—

1. Operating an army service command.
2. Operating a small section (advance, intermediate, or base) of a communications zone.
3. Operating a major territorial subdivision of one of the above, such as a base, a district, or an area.

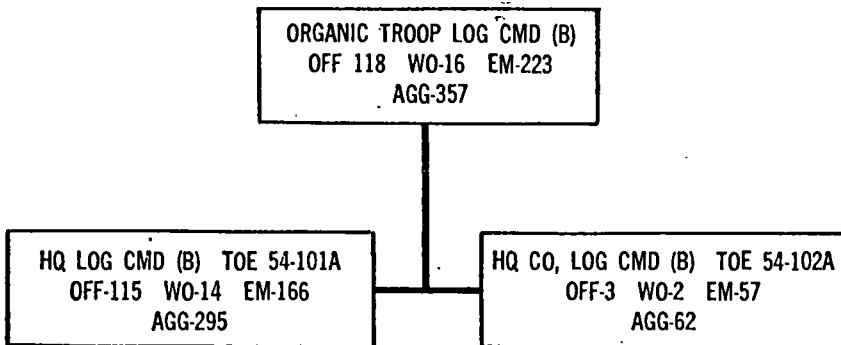
(b) Administration and rehabilitation of an area in which civil means are inadequate due to natural disaster or enemy action.

(3) Basis of Allocation: as required.

(4) Mobility: fixed.

c. Logistical Command (B).

(1) Diagram of Logistical Command (B) Organic Troops.



(2) Capabilities.

(a) When provided with appropriate service forces, to provide communications zone support to a combat force of approximately 100,000 men (comparable to a reinforced corps) by—

1. Operating a small section (advance, intermediate, or base) of a communications zone.
2. Operating a major territorial subdivision of one of the above, such as a base, a district, or an area.

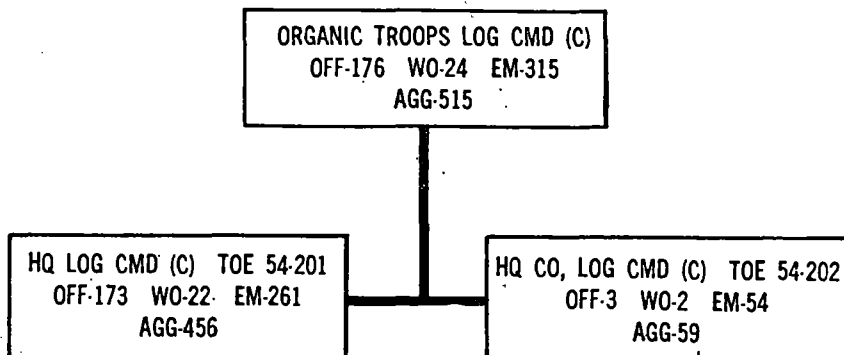
(b) Administration and rehabilitation of an area in which civil means are inadequate due to natural disaster or enemy action.

(3) Basis of Allocation: as required.

(4) Mobility: fixed.

d. *Logistical Command (C).*

(1) Diagram of Logistical Command (C) Organic Troops.



5-2907

(2) Capabilities.

(a) When provided with appropriate service forces, to provide communications zone support to a field army.

1. Operating a section (advance, intermediate, or base) of a communications zone.

2. Operating a major territorial subdivision of one of the above such as a base, a district, or an area.

3. Operating a small, undivided communications zone.

(b) Administration and rehabilitation of an area in which civil means are inadequate due to natural disaster or enemy action.

(3) Basis of Allocation: as required.

(4) Mobility: fixed.

b. Study the territory which will comprise the communications zone. Lines of communications, geography, climate, and extent of development all affect the troop list. A survey or estimate of probable destruction from enemy or other causes must be made.

c. Study the political organization, economy, density of population, probable attitude of the inhabitants, and extent of destruction of their installations and local government. Determine whether population will be controlled by military government or by civil affairs support of an existing government. Determine the size and composition of a military government staff for the communications zone headquarters as well as of a national military government headquarters for each nation in the communications zone. Determine needs for military government units by type of occupation and by major and minor political subdivisions of each country. Determine the requirements for psychological warfare forces for an effective consolidated propaganda program. Economy of personnel and established doctrine dictate adherence to existing political boundaries and governmental structure in determining military government requirements.

d. Determine a tentative organization of communications zone to include any necessary division into base, intermediate, or advance sections. The logistical command is a suitable nucleus for a communications zone section.

e. Add troop units of the technical and administrative services to the basic logistical commands as required for the accomplishment of the assigned missions.

f. Each service having been provided with an adequate troop list to accomplish its primary mission, check the troop list to ensure that it includes the following units for installations and headquarters involving more than one service.

- (1) *Adjutant general service.* Postal units at each major headquarters, port, depot, staging area, and recreation area.
- (2) *Engineer service.* Utilities detachments at each major headquarters, port, general depot, staging area, and recreation area. Fire-fighting detachments at each city, port, hospital, and troop camp.
- (3) *Finance service.* Finance disbursing sections at each major headquarters, hospital, port, and troop camp.
- (4) *Military police service.* Gate detachments at each major headquarters, hospital, port, and depot. Guard detachments for each train, Military Railway Service.

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- (5) *Quartermaster service.* Laundry detachments at each recreation area, staging area, and troop camp. Quartermaster service companies may be added to port and depot troop lists to increase their capacity with greater economy in trained manpower than would result if additional port companies, depot companies, and ammunition companies were added.
- (6) *Signal service.* Signal operations detachments at each major headquarters, port, hospital, depot, and troop camp.
- (7) *Transportation service.* Transportation car companies for major headquarters. Transportation truck units for depots, staging areas, ports, and recreation areas.
- (8) *Bulk allotment.* Sufficient bulk allotment must be provided to furnish personnel for the many headquarters and special organizations, not provided for in tables of organization and equipment. Normally the communications zone headquarters itself is chargeable against the bulk allotment. Headquarters for intersectional services may require tables of distribution from the bulk allotment. Each communications zone section will require a suballocation from the bulk allotment for the organization of district headquarters and recreation area headquarters, and for other special tasks.

g. Make a final check comparing the services to insure that they are balanced with each other.

h. Troop requirements for defense of communications zone installations, facilities, and lines of communications will vary with the terrain, size of the area, the local political situation and the enemy airborne, amphibious, and guerilla capability. Forces such as armored cavalry regiments, separate infantry regiments and battalions will be required. Locally recruited home guard units may be utilized to augment the above military forces. Divisional size units located in the communications zone may be used as defense forces in an emergency, however such employment would be by direction of the Theater Army Commander.

i. Figures on division slices are given in paragraph 53*a*. Figures on air wing slices are given in paragraph 53*b*. The total strength of the communications zone troop list should approximate the sum of the communications zone portions of the division slices and the air wing slices. The following figures are given as a further guide:

- (1) Advance section supporting an independent corps and operating a port, a small military railway service, and an area 50 miles deep by 20 miles wide; 35,000 to 50,000 total; a figure of 40,000 may be used as an early approximation.

FOREWORD

This manual is for use as a planning guide only. It provides general planning data for general staff officers of all echelons. Detailed reference data are found in tables of organization and equipment, field manuals, technical manuals, technical bulletins, and supply bulletins as outlined in DA Pamphlets in 310 series. The principles and procedures of administration are contained in FM 100-10; the duties of staff officers and the principles and procedures of staff action are contained in FM 101-5.

Where tons are shown, the short ton (2,000 lb) is intended unless the long ton (2,240 lb) or the measurement ton (40 cu ft) is specified.

Caution: Data contained herein are based on experience principally from World War II, and can be applied to the future only with judgment and discrimination. Wherever a known factor is available, it should be used instead of one from this manual.

Tables and examples in chapters 1 through 9 are not, in all cases, based on latest tables of organization and equipment, and computations must be adjusted accordingly.

All agencies will institute an immediate review of the contents of this manual and submit recommendations for changes or revision direct to Commandant, Command & General Staff College, Fort Leavenworth, Kans. within 120 days after receipt of this publication, and thereafter as changes to TOE or equipment effect contents of manual.

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FIELD MANUAL }
No. 101-10 }

DEPARTMENT OF THE ARMY
Washington 25, D. C., 6 September 1956

STAFF OFFICERS' FIELD MANUAL

ORGANIZATION, TECHNICAL, AND LOGISTICAL DATA

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*This manual supersedes FM 101-10, 8 July 1953.

Removed per Cir 310-36, June 58

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CHAPTER 1

ORGANIZATION

Section I. GENERAL

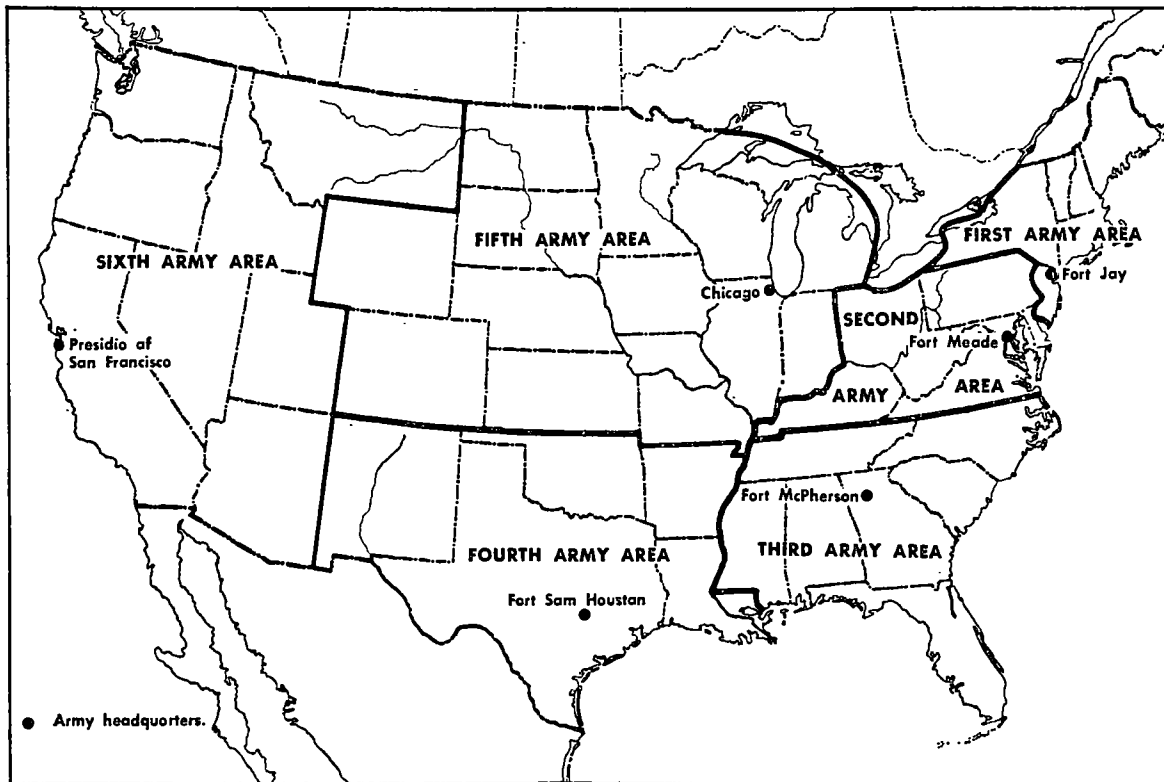
1. Department of the Army—Organization

(Fig. 1, Organization, Department of the Army, will be issued later.)

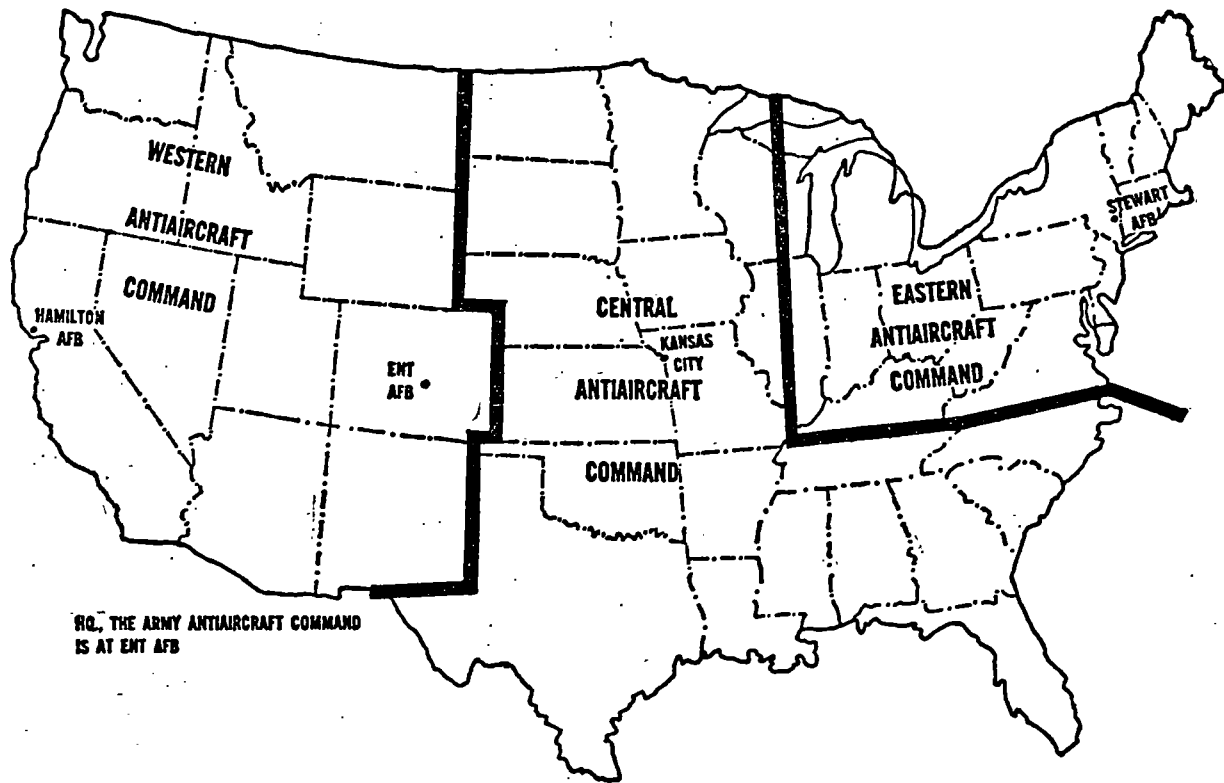
2. Army Areas and Army Antiaircraft Command

a. Army Areas.

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b. Army Antiaircraft Command.



HQ, THE ARMY ANTI-AIRCRAFT COMMAND
IS AT ENT AFB

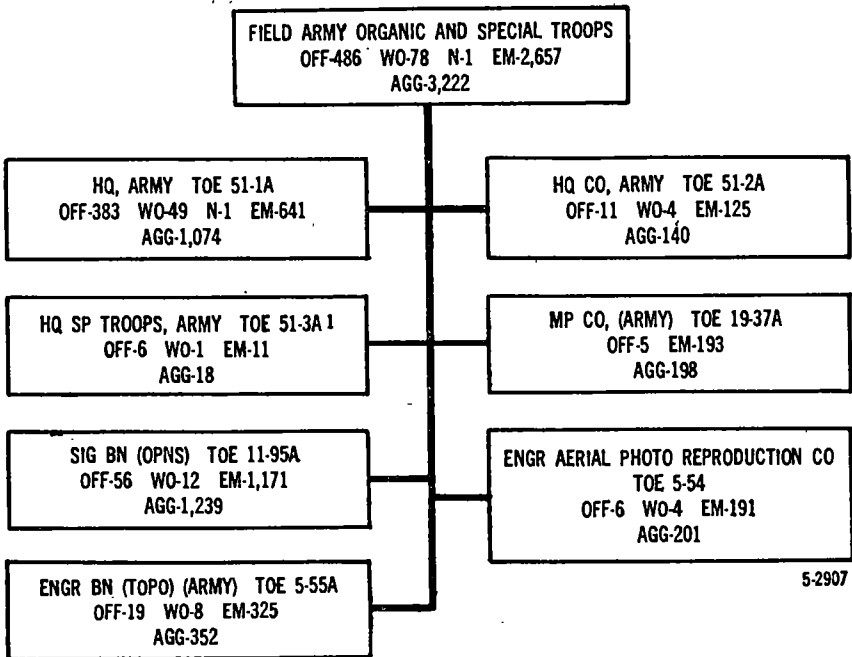
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Section II. FIELD ARMY, CORPS, TASK FORCE, AND LOGISTICAL COMMAND

3. Field Army

a. General. The field army is a flexible combat force capable of independent operations. Normally, it consists of a headquarters, organic army troops, two or more corps, and reinforcing combat and service troops. For composition of the branches of a field army see paragraphs 47 through 53.

b. Diagram of Field Army Organic and Special Troops.

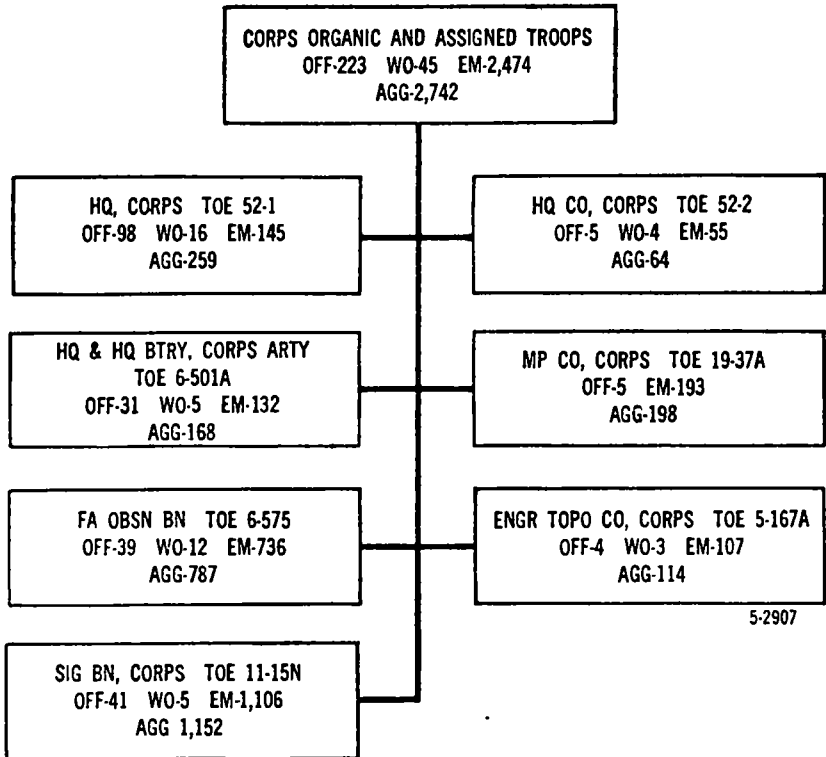


1 Medical service will be provided on an area basis by cellular teams from TOE 8-500 series as required.

4. Corps

a. General. The corps is a flexible combat force consisting of a headquarters, organic and assigned corps troops, two or more attached divisions, and reinforcing combat and service troops that may be attached in accordance with its mission. The functions of a corps in an army are primarily tactical. The functions of a separate corps are both tactical and administrative.

b. Diagram of Corps, Organic and Assigned Troops.



5. Task Force

A task force consists of those units (command, intelligence, combat, and service) necessary to carry out certain planned operations (tasks). It has no fixed organization and may be organized from Army, Navy, or Air Force units, or it may be a combination of any two or of all three. A task force designed for one operation might be especially strong in armored units; in another, amphibious units might be predominant.

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a. General. The logistical command is a highly flexible organization consisting of a headquarters and headquarters company and the requisite force of service units organized to execute a specific administrative or logistical support mission augmented by tactical units if required for rear area defense. The logistical command is normally assigned to the communications zone, but may be assigned or attached to an army or an independent task force for the purpose of operating a service command in support thereof. Logistical commands are not normally assigned or attached to a field army which is part of a Theater Army Organization.

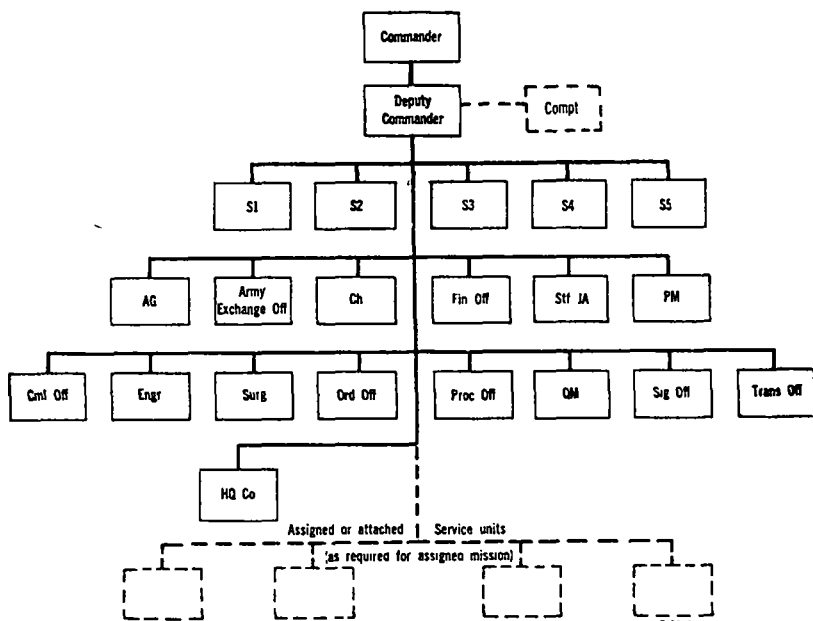
b. Headquarters, Logistical Command. A headquarters and headquarters company is organic to the logistical command. The organization of these headquarters is flexible and should be tailored to fit the mission assigned. The staff organization will be designed to fit the responsibilities of the command.

c. Service Units. Service units of the required numbers and types are assigned or attached as necessary to accomplish the assigned mission. Nondivisional logistical units will be standard or cellular TOE technical service units organized into optimum sized major units for specific tasks.

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(1) *Logistical Command Type A (TOE 54-1 and 54-2).*

(a) *Organizational chart for headquarters, logistical command A.*



(b) *Capabilities.*

1. When provided with appropriate technical and other service forces, to furnish army or communications zone type support to a combat force of approximately 30,000 men by—
 - (a) Operating a service command in support of a separate field army, or
 - (b) Operating a small section (advance, intermediate, or base) of a communications zone, or
 - (c) Operating a major territorial subdivision of one of the above, such as a base, a district, or an area.

2. When provided with appropriate technical and other services forces, administration and rehabilitation of an area in which civil means are inadequate because of natural disaster or enemy action.

(c) *Strength...*

1. Headquarters, and headquarters company, logistical command A: Off 55 ANC 1 WO 4 EM 122 Agg. 182.

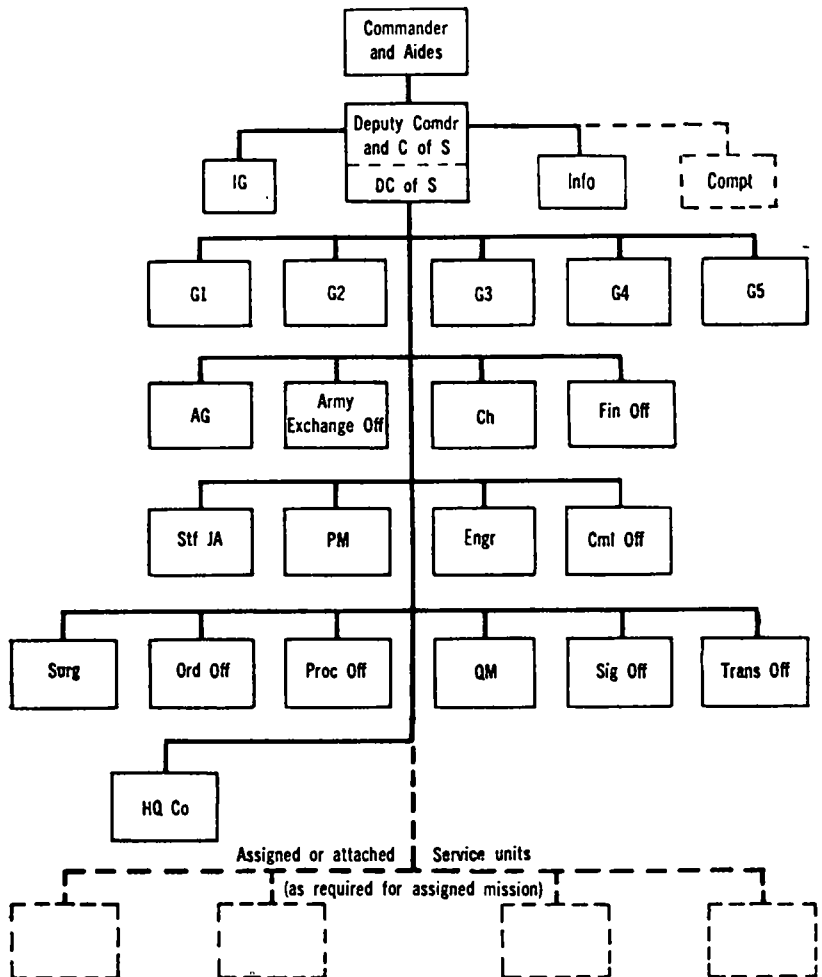
2. Logistical command A: Agg 182 plus assigned or attached technical and other service forces (9,000 to 15,000).

- (d) *Basis of allocation.* One per supported force of approximately 30,000 troops when required to provide administrative support; or 1 per separate administrative or logistical mission, as required.

- (e) *Mobility.* Commensurate with the mission and the force being supported.

(2) *Logistical Command Type B (TOE 54-101 and 54-102).*

- (a) *Organizational chart for headquarters, logistical command B.*



(b) *Capabilities.*

1. When provided with appropriate technical and other service forces, to provide communications zone type support to a combat force of approximately 100,000 men by—
 - (a) Operating a small section (advance or base) of a communications zone, or
 - (b) Operating a major territorial subdivision of one of the above, such as a base, a district, or an area, or
 - (c) Operating a service command in support of an independent task force.
2. When provided with appropriate technical and other service forces, administration and rehabilitation of an area in which civil means are inadequate because of natural disaster or enemy action.

(c) *Strength.*

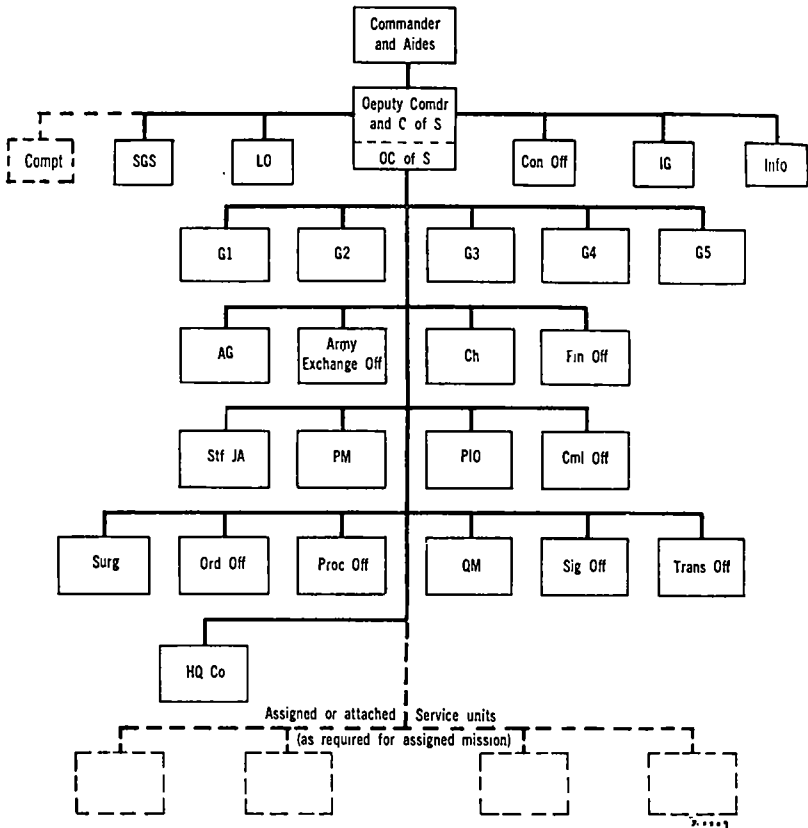
1. Headquarters and headquarters company, logistical command B: Off 117 ANC 1 WO 17 EM 222
Agg 357.
2. Logistical command B: Agg 357 plus assigned or attached technical and other service forces (35,000 to 60,000).

(d) *Basis of allocation.* One per supported force of approximately 100,000 troops when required to provide administrative support; or 1 per separate administrative or logistical mission, as required.

(e) *Mobility.* Commensurate with the mission and the force being supported.

(3) *Logistical Command Type C* (TOE 54-201 and 54-202).

(a) *Organizational chart for headquarters, logistical command C.*



(b) *Capabilities.*

1. When provided with appropriate technical and other service forces, to provide communications zone type support to a field army or army group by—
 - (a) Operating a small, undivided communications zone, or
 - (b) Operating a section (advance or base) of a communications zone, or
 - (c) Operating a major territorial subdivision of one of the above, such as a base, a district, or an area.

2. When provided with appropriate technical and other service forces, administration and rehabilitation of an area in which civil means are inadequate because of natural disaster or enemy action.

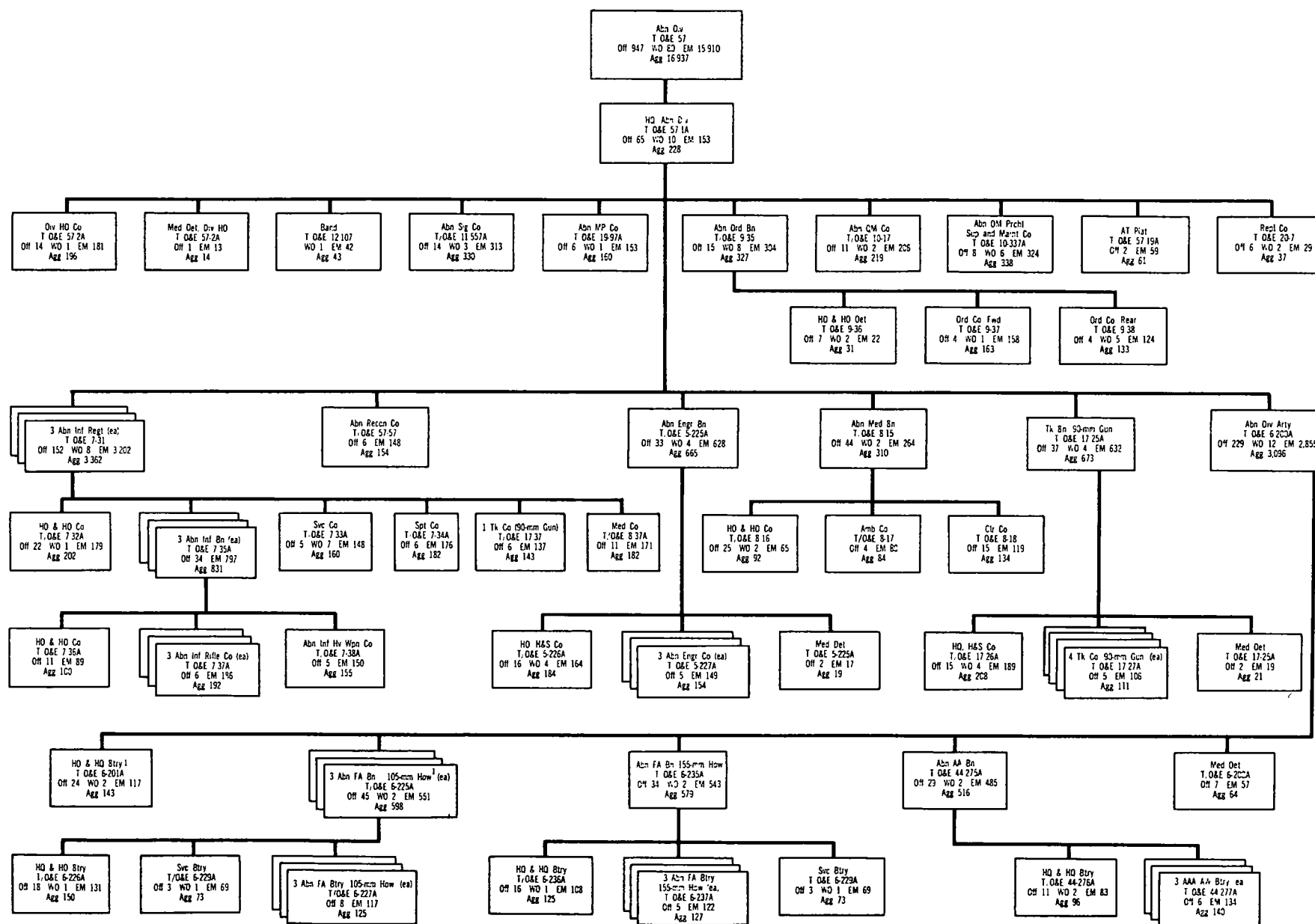
(c) *Strength.*

1. Headquarters and headquarters company, logistical command C: Off 171 ANC 1 WO 24 EM 309 Agg 505.
2. Logistical command C: Agg 505 plus assigned or attached technical and other service forces (75,000 to 150,000).

- (d) *Basis of allocation.* One per supported force of approximately 400,000 troops when required to provide administrative support; or 1 per separate administrative or logistical mission, as required.

- (e) *Mobility.* Commensurate with the mission and the force being supported.

Section III. AIRBORNE DIVISION



1 Includes one ACT.

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396022 O-56 (Face p. 10) No. 1



8. Airborne Division—Weapons

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49		
Weapons	Total abn div	Div trp										Abn med bn			Abn ord bn			3 abn inf regt (ea)										Abn engr bn			Tk bn 90-mm gun		Abn div arty																	
		HQ, abn div	Div HQ co ¹	Band	Abn sig co	Abn MP co	Abn QM co	Abn QM prehtsup & maint co	Abn recon co	AT plat	Repl co	Total bn	HQ & HQ co	Amb co	Clk co	Total bn	HQ & HQ det	Ord co fwd	Ord co rear	Total regt	HQ & HQ co	Svc co	Spt co	Tk co 90-mm gun	Med co	3 abn inf bn (ea)				Total bn	HQ, H&S co ²	3 abn engr co (ea)	Total bn	HQ, H&S co ²	4 tk co 90-mm gun (ea)	Total abn div arty ³	HQ & HQ btry ³	3 abn FA bn 105-mm how (ea)				Abn FA bn 155-mm how				Abn AAA AW bn				
																										Total bn	HQ co	3 abn inf rifle co (ea)	Abn inf hv wpns co									Total bn	HQ & HQ btry ⁴	3 abn FA btry ⁴	Svc btry	Total bn	HQ & HQ btry	3 FA btry (ea)	Svc btry	Total bn	HQ & HQ btry	3 AAA AW btry (ea)		
Cbn, cal .30, M2.....	5,110	133	29	43	199	29	149	205	45	22	26	(122)	37	35	50	(159)	13	71	75	(798)	55	16	65	45	62	(185)	32	29	66	(107)	65	14	(262)	114	37	(1,186)	74	(246)	66	46	42	(207)	54	37	42	(167)	35	44		
Gun, 40-mm, M1, on carriage M2 A1, with E&S.....	24																			(6)			6																							8				
Gun, AT, 90-mm, on carriage, abn.....	24									6										(12)						(4)			4																					
Gun, machine, cal .30, Browning, M1917 A1.....	36																																																	
M1919 A4, flexible.....	103					3			18							(10)		10													(18)		6	(12)	12		(42)	2	(10)	2	2	2	(10)	2	2	2				
M1919 A6.....	204																			(68)	2					(22)		6	4																					
Gun, machine, cal .50, Browning, M2, hv barrel, flexible.....	414	2			6	1	11	1	3	3	1					(11)		6	5	(60)	3	16	7	1		(11)	3	1	5	(24)	12	4	(14)	10	1	(157)	5	(26)	6	5	5	(22)	5	4	5	(52)	4	16		
Gun, submachine, cal .45, M3 A1.....	895	18			43	52	4	12	30							(50)	4	36	10	(37)	5			32						(51)	24	9	(156)	64	23	(368)	26	(72)	31	12	5	(52)	23	8	5	(74)	20	18		
Gun, tk, 76-mm.....	2																																																	
Gun, tk, 90-mm.....	138																			22				22								(72)	4	17																
How, 75-mm pack, M1 A1, on carriage, M8, with E&S ¹	54																																																	
105-mm, M1 A1, on carriage, M2 A2, with E&S.....	54																																																	
155-mm, M1, on carriage, M1 A2, with E&S.....	18																																																	
Launcher, rkt. 3.5-in., M20.....	616	6			10	3	5	7	9	6	4					(6)	1	3	2	(88)	4	10	9	2		(21)	5	3	7	(31)	4	9	(20)	12	2	(245)	6	(46)	7	10	9	(45)	6	10	9	(56)	5	17		
Mort, 60-mm, M19, on mount, M5, with E&S.....	81																			(27)						(9)		3																						
81-mm, M21, on mount, M15, with E&S.....	40								3											(12)						(4)			4				(1)	1																
4.2-in., M2.....	24																			(8)			8																											
Multiple, .50 cal MG, M55, trailer mounted.....	24																																																8	
Pistol, Auto, cal .45, M1911 A1.....	2,151	31	22		14	14	3	1	19	12		(10)	2	1	7	(7)	5	1	1	(527)	7	1	28	110	6	(125)	3	30	32	(7)	7		(371)	31	85	(59)	16	(10)	6	1	1	(10)	6	1	1	(3)	3			
Rifle, Auto, cal .30, Browning, M1918 A2.....	501	11							3											(162)						(54)		18					(1)	1																
US, cal .30, M1.....	7,813	57	123		74	65	63	120	57	27	11	(23)	7	6	10	(111)	9	55	47	(1,708)	132	114	89		23	(440)	65	106	57	(489)	96	131	(21)	21		(1,448)	56	(270)	47	66	25	(310)	42	81	25	(272)	38	78		
US, cal .30, M1C (snipers).....	243																			(81)						(27)		9																						
57-mm, M18.....	81																			(27)						(9)		3																						
75-mm, M20.....	24								6											(6)						(2)			2																					
106-mm, on mount, recoilless.....	57	3																		(18)						(6)			6																					
Total crew served wpns.....	1,964	11			16	7	16	8	39	15	5					(27)	1	19	7	(354)	9	26	30	25		(88)	8	16	32	(73)	16	19	(121)	41	20	(564)	13	(100)	15	23	16	(95)	13	22	16	(156)	9	49		
Total indiv wpns.....	16,713	221	203	43	330	160	219	338	154	61	37	(155)	46	42	67	(327)	31	163	133	(3,313)	199	161	182	187	91	(831)	100	192	153	(654)	192	154	(811)	231	145	(3,061)	172	(598)	150	125	73	(579)	125	127	73	(516)	96	140		
Total wpns.....	18,677	221	214	43	346	167	235	346	193	76	42	(155)	46	42	67	(354)	32	182	140	(3,667)	208	187	212	212	91	(919)	108	208	187	(727)	208	173	(932)	272	165	(3,625)	185	(698)	165	148	89	(674)	138	149	89	(672)	105	189		

¹ Issued in lieu of 105-mm how when authorized by ZI army commander or theater of operations commander.

² Includes med det wpns.

³ Includes wpns for ground force ACT pers.

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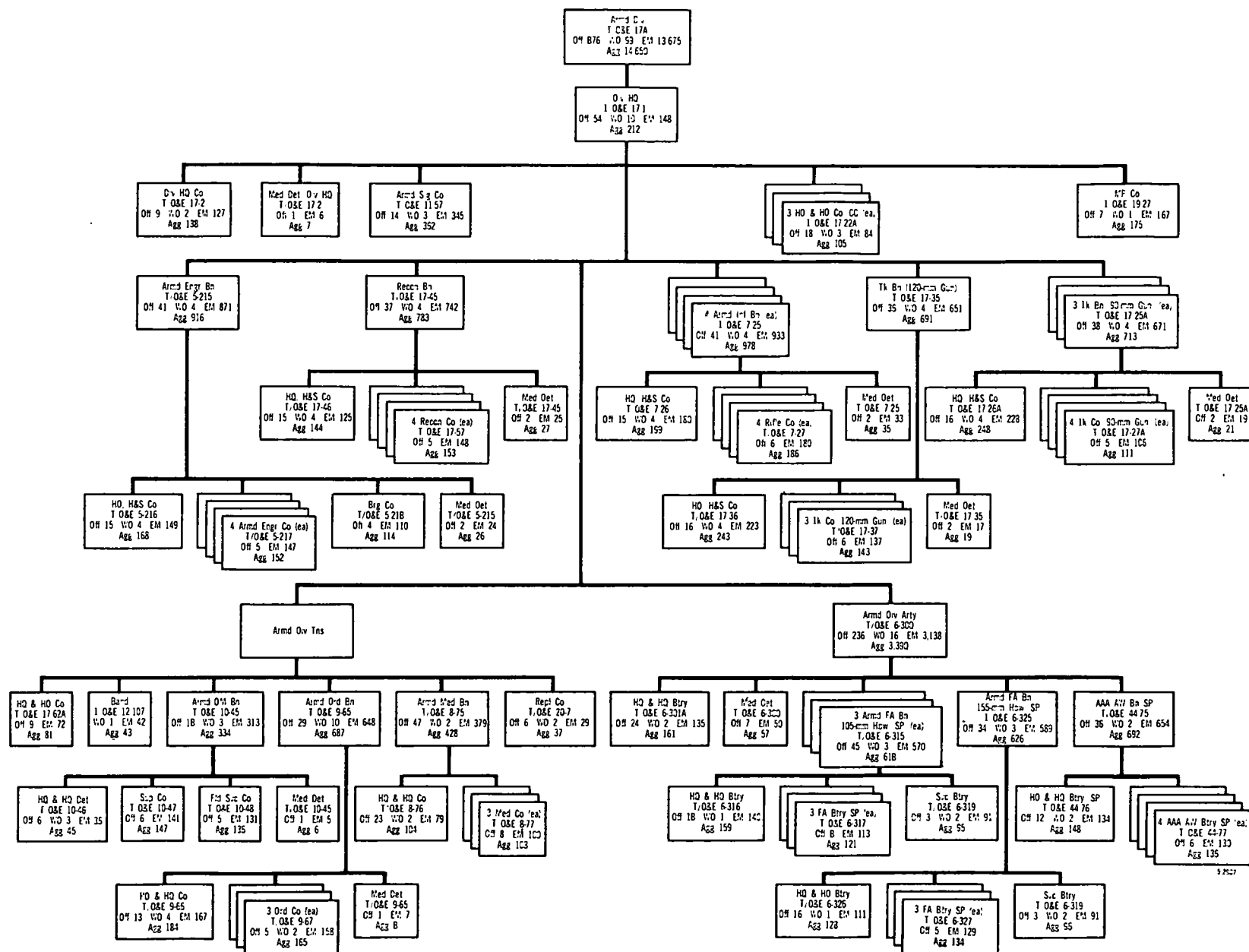
9. Airborne Division—Vehicles and Major Equipment

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Section IV. ARMORED DIVISION

10. Armored Division—Organization



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11. Armored Division—Weapons

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49							
	Weapons	Units	Total arm'd div	Div trp				Recon bn			Arm'd engr bn				Tk bn 120-mm gun			Arm'd inf bn (4 ea)		Tk bn 90-mm gun (3 ea)		Div arty												HQ & HQ co, div tns	Arm'd div band	Repl co	QM bn				Ord bn			Arm'd med bn												
Div HQ				HQ co, arm'd div 1	Arm'd sig co	MP co	3 HQ & HQ co CC (ea)	Total bn 1	HQ, H&S co 1	4 recon co (ea)	Total bn	HQ, H&S co 1	Brg co	4 arm'd engr co (ea)	Total bn 1	HQ, H&S co 1	3 hv tk co (ea)	Total bn 1	HQ, H&S co 1	4 rifle co (ea)	Total bn 1	HQ, H&S co 1	4 tk co 90-mm gun (ea)	Total div arty 1 2	HQ & HQ btry 1 2	Arm'd FA bn 105-mm how SP (3 ea)				Arm'd FA bn 155-mm how SP							AAA AW bn SP																			
																										Total bn 2	HQ & HQ btry 2	3 FA btry (ea)	Svc btry	Total bn	HQ & HQ btry	3 FA btry (ea)	Svc Btry				Total bn	HQ & HQ btry	4 AAA AW btry SP (ea)																	
1	Cbn, cal .30.....	5,596	126	41	208	35	55	(327)	103	56	(143)	60	19	16	(260)	125	45	(264)	128	34	(276)	128	37	(1,594)	74	(256)	61	55	30	(203)	50	41	30	(549)	109	110	25	43	27	(180)	29	74	77	(367)	100	89	(171)	42	43							
2	Gun AA, 40-mm, twin.....	32																																																						
3	Gun, machine, cal .30, hv.....	4																(1)	1																																					
4	Gun, machine, cal .30, lt.....	519		6		3	3	(41)	5	9	(29)	3	2	6	(16)	16		(83)	11	18	(12)	12		(42)	2	(10)	2	2	2	(10)	2	2	2			5																				
5	Gun, machine, cal .50.....	296		4	8	1	2	(18)	6	3	(28)	7	13	2	(14)	11	1	(10)	6	1	(15)	11	1	(71)	3	(14)	4	2	4	(13)	3	2	4	(13)	5	2	2	1	(32)		14	18	(28)	7	7											
6	Gun, multiple, cal .50 (4 guns ea).....	32																						(32)										(32)		8																				
7	Gun, submachine, cal .45.....	2,159	5	45	56	56	29	(118)	42	19	(88)	32	8	12	(168)	72	32	(127)	35	23	(165)	73	23	(406)	31	(63)	24	11	6	(49)	19	8	6	(139)	35	26	35			(21)	6	6	9	(69)	21	16										
8	Gun, tk, 76-mm.....	58		3			3	(30)	2	7					(2)	2		(2)	2																																					
9	Gun, tk, 90-mm.....	216																																																						
10	Gun, tk, 120-mm 1.....	69													(69)	3	22																																							
11	How, 105-mm.....	54																						(54)		(18)		6																												
12	How, 155-mm.....	18																						(18)						(18)		6																								
13	Launcher, 4kt, 3.5-in.....	686		8	10	3	9	(37)	13	6	(44)	4	4	9	(20)	14	2	(56)	16	10	(22)	14	2	(210)	6	(39)	13	8	2	(35)	9	8	2	(52)	8	11	4		4	(12)	2	6	4	(17)	5	4										
14	Mort, hv.....	32													(4)	4		(4)	4		(4)	4																																		
15	Mort, 81-mm.....	68						(12)		3					(1)	1		(13)	1	3	(1)	1																																		
16	Pistol, auto, cal .45.....	2,363	29	19	14	105	22	(154)	14	35	(7)	7			(365)	35	110	(94)	22	18	(379)	39	85	(62)	19	(10)	6	1	1	(10)	6	1	1	(3)	3		3			(5)	3	1	1	(10)	7	1	(11)	2	3							
17	Rifle, auto, cal .30.....	167		3				(12)		3					(1)	1		(37)	1	9	(1)	1																																		
18	Rifle, cal .30, M1.....	4,588	45	40	84	69		(220)	4	54	(663)	80	87	124	(30)	30		(408)	36	93	(30)	30		(1,244)	63	(289)	68	54	59	(364)	53	84	59				17		12	(125)	10	66	49	(237)	60	59	(30)	6	8							
19	Rifle, cal .30 (sniper).....	144																(36)		9																																				
20	Rifle, 75-mm, M20.....	3		3																																																				
21	Crew-served wpns.....	2,069		24	18	7	17	(138)	26	28	(101)	14	19	17	(126)	51	25	(169)	41	32	(128)	48	20	(459)	11	(81)	19	18	8	(76)	14	18	8	(129)	13	29	11		5	(44)	2	20	22	(45)	12	11										
22	Indiv wpns.....	15,017	205	148	362	265	106	(831)	163	167	(901)	179	114	152	(524)	263	187	(966)	222	186	(851)	271	145	(3,358)	187	(618)	169	121	96	(626)	128	134	96	(691)	147	136	80	43	39	(331)	48	147	136	(683)	188	165	(212)	50	54							
23	Total wpns.....	17,106	205	172	380	272	123	(969)	189	195	(1,002)	193	133	169	(950)	314	212	(1,135)	263	218	(979)	319	165	(2,817)	198	(999)	178	139	104	(702)	142	152	104	(820)	160	165	91	43	44	(375)	50	167	158	(728)	200	176	(212)	50	54							

1 Indiv wpn of med det are included.
2 Includes wpns of ground force ACT pers.
3 See footnote 4, paragraph 12.

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12. Armored Division—Vehicles and Major Equipment

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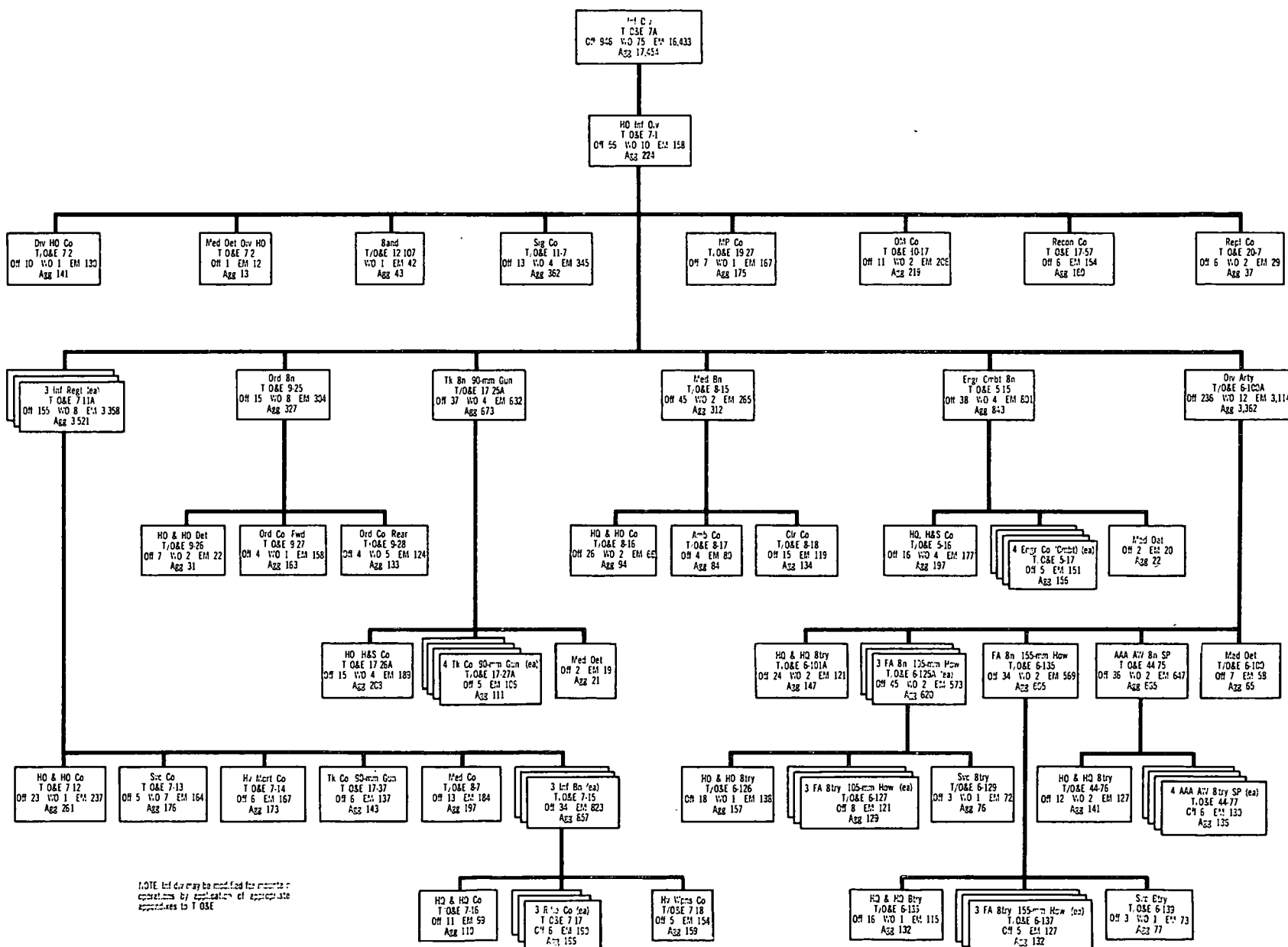
1 Includes both with and without wheelchair
 2 Include - med det veh.
 3 Include - vehicles of ACT.
 4 Substitute 11 - by 90-mm gun

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13. Infantry Division—Organization

Section V. INFANTRY DIVISION



NOTE: Inf div may be modified for missions & operations by duplication of appropriate agencies to T. O&E

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14. Infantry Division—Weapons

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47		
Weapons		Div trp																	Inf regt (3 ea)								Tk hn 90-mm gun		Engr cmbt hn		Div arty																		
		Units																	Inf bn (3 ea)								Total bn ¹ HQ, H&S co ¹ 4 tk co 90-mm gun (ea)		Total bn ¹ HQ, H&S co ¹ 4 engr cmbt co (ea)		Total div arty ^{1,2} HQ & HQ btry ^{1,2}		FA hn (105-mm how) (3 ea)				FA hn (155-mm how)				AAA AW hn SP								
																																	Total bn	HQ & HQ det	Ord co fwd	Ord co rear	Total bn	HQ & HQ co	Amb co	Clr co	Total regt	HQ & HQ co	Svc co	Hv mort co	Tk co 90-mm gun	Med co	Total bn	HQ & HQ co	3 rifle co (ea)
1 Chn, cal .30.....	5,307	128	25	43	208	35	149	62	26		(159)	13	71	75	(122)	37	35	50	(788)	61	14	54	45	71	(181)	28	29	66	(262)	114	37	(122)	58	16	(1,602)	77	(255)	65	48	46	(210)	54	38	44	(548)	108	110		
2 Gun, 40-mm twin.....	32																		(12)						(4)			4						(32)												8			
3 Gun, machine, cal .30, hv.....	36																		(69)	3					(22)		6	4	(12)	12		(26)	2	6	(42)	2	(10)	2	2	2	(10)	2	2	2					
4 Gun, machine, cal .30, lt ²	309					3		9			(10)		10						(60)	4	16	6	1		(11)	3	1	5	(14)	10	1	(28)	12	4	(98)	2	(21)	6	4	3	(20)	5	4	3	(13)	5	2		
5 Gun, machine, cal .50 ³	356		2		7	1	11	3	1		(11)		6	5																						(32)													
6 Gun, machine, cal .50, multiple mount (4 guns).....	32																																																
7 Gun, submachine, cal .45.....	962		2		58	56	4	20			(50)	4	36	10					(37)	5			32						(156)	64	23	(48)	24	6	(457)	29	(78)	34	13	5	(61)	26	10	5	(133)	29	26		
8 Gun, 76-mm.....	9							7																						(2)	2																		
9 Gun, 90-mm.....	138																		(22)				22						(72)	4	17																		
10 How, 105-mm.....	54																																				(34)												
11 How, 155-mm.....	18																																				(18)												
12 Launcher, rkt, 3.5-in.....	568		6		10	3	5	6	4		(6)	1	3	2					(86)	7	10	4	2		(21)	5	3	7	(20)	12	2	(40)	4	9	(210)	3	(39)	7	10	2	(38)	6	10	2	(52)	8	11		
13 Mort, 60-mm.....	81																		(27)						(9)		3																						
14 Mort, 81-mm ²	39																		(12)						(4)			4																					
15 Mort, 4.2-in.....	36																		(12)			12																											
16 Pistol, auto, cal .45.....	2,217	29	14		14	105	3	35			(7)	5	1	1	(10)	2	1	7	(520)	7	1	24	110	3	(125)	3	30	32	(371)	31	85	(7)	7		(62)	19	(10)	6	1	1	(10)	6	1	1	(3)	3			
17 Rifle, cal .30, M1.....	8,091	60	104		82	69	63	54	11		(111)	9	55	47	(23)	7	6	10	(1,876)	185	161	95		25	(470)	79	110	61	(21)	21		(658)	118	135	(1,207)	54	(277)	52	67	24	(322)	46	83	27					
18 Rifle, cal .30, M1C (sniper).....	243																		(81)						(27)		9																						
19 Rifle, auto, cal .30.....	493		3					3											(162)						(54)		18		(1)	1																			
20 Rifle, 57-mm, M18.....	81																		(27)						(9)		3																						
21 Rifle, 106-mm, on mount.....	57		3																(18)						(6)			6																					
22 Individual wpns.....	17,313	217	148	43	362	265	219	174	37		(327)	31	163	133	(155)	46	42	67	(3,464)	258	176	173	187	99	(857)	110	196	159	(811)	230	145	(835)	207	157	(3,328)	179	(620)	158	129	76	(605)	132	132	77	(684)	140	136		
23 Crew-served wpns.....	1,843		11		17	7	16	25	5		(27)	1	19	7					(345)	14	26	22	25		(86)	8	16	30	(120)	41	20	(94)	18	19	(486)	7	(88)	14	22	7	(86)	13	22	7	(129)	13	29		
24 Total wpns.....	19,156	217	159	43	379	272	235	199	42		(354)	32	182	140	(155)	46	42	67	(3,809)	272	202	195	212	99	(943)	118	212	189	(931)	271	165	(929)	225	176	(3,814)	186	(708)	172	151	83	(691)	145	154	84	(813)	153	165		

¹ Includes med det wpns.
² Does not include wpns mounted in combat veh.
³ Includes wpns for ground force ACT pers.

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15. Infantry Division—Vehicles

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47				
		Div trp										Inf rept (3 ea)										Tk bn 90-mm gun		Engr embit bn		Div arty																									
												Ord hn					Med bn					Inf bn (3 ea)												FA bn 105-mm how (3 ea)					FA bn 155-mm how					AAA AW bn							
Vehicles		Units	Total inf div	Div HQ	HQ co, inf div	Inf div band	Sig co	MP co	QM co	Recon co	Repl co	Total bn	HQ & HQ det	Ord co fwd	Ord co rear	Total bn	HQ & HQ co	Amb co	Clr co	Total regt	HQ & HQ co	Svc co	Hv mort co	Tk co 90-mm gun	Med co	Total bn	HQ & HQ co	3 rifle co (ea)	Hv wpns co	Total bn	HQ, H&S co	4 tk co 90-mm gun (ea)	Total bn	HQ, H&S co	4 engr embit co (ea)	Total div arty	HQ & HQ bury	Total bn	HQ & HQ bury	3 FA bury (ea)	Svc bury	Total bn	HQ & HQ bury	4 AAA AW bury (ea)							
AIRCRAFT																																																			
1	Aircraft, observation.....	5		1																(1)	1															(1)	1														
2	Aircraft, utility.....	3		2																																(1)	1														
3	Helicopter, reconnaissance.....	10		3		2														(1)	1													(1)	1																
TRACK VEHICLES																																																			
4	Carriage, 81-mm mort, half-track.....	4								3																							(1)	1																	
5	Carriage, motor, multiple gun (.50 cal MG).....	32																																																	
6	Carriage, motor, twin 40-mm gun.....	32																																																	
7	Tank, 76-mm gun.....	9								7																								(2)	2																
8	Tank, 90-mm gun.....	138																		(22)				22									(72)	4	17																
9	Tractor, high speed, 13-ton.....	22																																				(22)													
10	Vehicle, armored, infantry.....	3								3																																									
11	Vehicle, armored, utility.....	11								2										(1)				1									(6)	2	1																
12	Vehicle, tank recovery.....	19										(8)			6					(2)			1		1							(6)	2	1				(1)								(1)	1				
WHEEL VEHICLES																																																			
13	Automobile, sedan, M 5-passenger.....	1		1																																															
14	Motorcycle, solo, chain-driven.....	8																																																	
15	Truck, 1/2-ton, utility.....	1,097		37		31	42	10	20	2		(22)	4	13	5	(19)	11	4	4	(214)	38	8	10	6	14	(46)	12	4	22		(28)	20	2		(31)	15	4	(213)	22		(45)	22	7	2	(28)	14	4	2	(28)	12	4
16	Truck, 3/4-ton, 4 X 4, ambulance.....	38		1												(30)		30														(1)	1		(2)	1		(5)	5												
17	Truck, 3/4-ton, 4 X 4, comd wpn carr.....	64				9	4																												(2)	2		(49)	10		(10)	8	1	1	(9)	5	1	1			
18	Truck, 3/4-ton, 4 X 4, cargo.....	298		5		9		4	1			(28)	1	23	4	(4)	2		2	(43)	7	3	16			5	(4)	1		3		(4)	4		(13)	5	2	(101)	3		(23)	8	5	2	(21)	7	4	2	(8)		2
19	Truck, 2 1/2-ton, 6 X 8, air compressor.....	5																																																	
20	Truck, 2 1/2-ton, 8 X 6, bolster body.....	3																																																	
21	Truck, 2 1/2-ton, 6 X 8, cargo, M35.....	762		11		35	3	68	3	2		(30)	1	2	27	(24)	7	3	14	(87)	5	48	4	2	4	(8)	4	1	1		(45)	37	2		(23)	15	2	(257)	15		(50)	7	11	19	(33)	5	3	19	(32)	18	4
22	Truck, 2 1/2-ton, 6 X 8 dental lab.....	1										(1)	1																																						
23	Truck, 2 1/2-ton, 6 X 8, dump.....	65																																				(65)	17	12											
24	Truck, 2 1/2-ton, 8 X 6, SigC, repair.....	4				4																																													
25	Truck, 2 1/2-ton, 6 X 6, shop eqp (enrg).....	1																																																	
26	Truck, 2 1/2-ton, 8 X 6, shop van.....	8										(8)	1		7																																				
27	Truck, 4-ton, 6 X 6, cargo SWB.....	9																																																	
28	Truck, 4-ton, 8 X 6, wrecker.....	4						1																																											
29	Truck, 5-ton, 8 X 8, mil brg.....	8																																																	
30	Truck, med wrecker 5 ton 8 X 8.....	5																		(1)		1																													
31	Truck, 6-ton, 8 X 6, tractor.....	14																																																	
32	Truck, 6-ton, 6 X 6, hv wrecker.....	11										(8)		8	2																																				
33	Truck, 12-ton, 6 X 6, tractor.....	2										(2)			2																																				

¹ Includes med det veh.

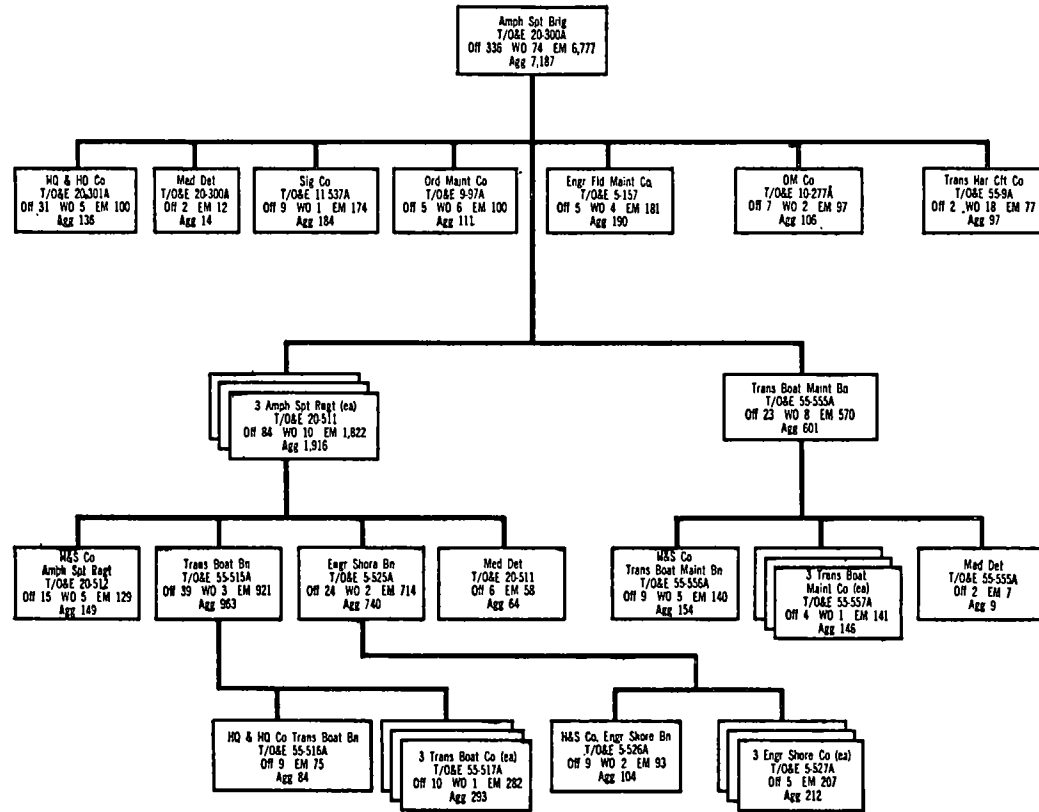
* Includes veh for ACT.

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16. Amphibious Support Brigade—Organization



Section VI. AMPHIBIOUS SUPPORT BRIGADE

17. Amphibious Support Brigade—Weapons

1	1	2	3	4	5	6	7	8	9	10
		Total Brigade	Amphibious Support Brigade (TOE 20-300)							
			Hq & Hq Co (TOE 20-301)*	Signal Co (TOE 11-537)	Ord Co (TOE 9-97)	Engr Fld Maint Co (TOE 5-157A)	Quartermaster Co (TOE 10-277)	Trans Harbor Crft Co (TOE 55-9)	3 Amphib Spt Regt (ea) (TOE 5-311)*	Trans Boat Maint Bn (TOE 55-555)*
2	Carbine, cal .30.....	5,099	82	115	53	160	59	97	1,343	504
3	Gun, machine, cal .30 1919A4.....	36	---	---	---	---	---	---	12	---
4	Gun, machine, cal .50, AN-M3 aircraft, basic.....	286	---	---	---	---	---	16	90	---
5	Gun, machine, cal .50, flexible.....	55	1	4	5	3	4	---	10	8
6	Gun, submachine, cal .45.....	222	18	22	11	10	9	---	48	8
7	Launcher, rocket, 3.5 in.....	145	2	3	2	4	2	---	40	12
8	Pistol, auto, cal .45.....	72	19	3	2	---	2	---	14	4
9	Rifle, cal .30, M-1.....	1,723	18	45	46	21	40	---	489	86
10	Rifle, 75-mm, M20.....	18	---	---	---	---	---	---	6	---

*Incl Med Det.

18. Amphibious Support Brigade—Vehicles and Major Equipment

1	2	3	4	5	6	7	8	9	10
1	Total brigade	Amphibious Spt brigade, TOE 20-300A							
		Hq & Hq Co (TOE 20-301A)*	Signal Co (TOE 11-537A)	Ord Co (TOE 9-97A)	Engr Fld Maint Co (TOE 5-157)	Quarter- master Co (TOE 10-277A)	Trans Harbor Cft Co (TOE 55-9A)	3 Amphib Spt Regts (ea) (TOE 20-511)*	Trans Boat Maint Bn (TOE 55-555A)*
2 E Compressor, air, set No. 1, 55 cfm.....	10								10
3 E Compressor, air, truck-mounted, 210 cfm.....	21							7	
4 E Crano, nonrevolving, wheeled, 40,000 lb capacity, 20-ft boom.....	19							3	10
5 E Crano shovel, Crawler, 7-10 ton, ¼ cu yd.....	15							5	
6 E Crane shovel, power unit, revolving truck-mounted, 20-ton, ¼ cu yd.....	17				1			3	7
7 E Fire and salvage equip set No. 1, Marino.....	18							3	9
8 E Firefighting equipment, set No. 2.....	3							1	
9 E Firefighting equipment, with Truck, Set No. 18, 500 GPM.....	3							1	
10 E Generator set, portable, diesel-driven, skid-mounted, 15 KW.....	2				2				
11 E Generator set, Portable, gasoline-driven, skid-mounted, 30 KW.....	3								3
12 E Grador, road, motorized, diesel.....	6							2	
13 E Grador, road, towed.....	3							1	
14 E Hammer, pneumatic or steam, pile-driver, 3,000-lb.....	15							5	
15 E Lubricator, trailer-mounted.....	4				1			1	
16 E Power plant, trailer-mounted, 5 KW.....	3								3
17 E Pump, sump, 3" discharge, 175 GPM.....	0							3	
18 E Pump, centrifugal, gasoline-driven, tlr mounted, 4" discharge, 500 GPM.....	4								4
19 E Roller, road, towed, sheepfoot.....	3							1	
20 E Rooter, road, cable operated, 3-tooth.....	3							1	
21 E Scraper, road, towed, cable operated, 12 cu yd.....	9							3	
22 E Semitrailer, front loading, low bed, 20-ton.....	23				1			7	1
23 E Shop equipment, base maint, Set No. 1, electrical.....	1								1
24 E Shop equipment, base maint, Set No. 3, general repair.....	1								1
25 E Shop equipment, base maint, Set No. 4, machine shop.....	1								1
26 E Shop equipment, base maint, Set No. 5, motor.....	1								1

* Incl Med det.

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18. Amphibious Support Brigade—Vehicles and Major Equipment—Continued

1	2	Amphibious Spt brigade, TOE 20-300A							
		Hq & Hq Co (TOE 20-301A)*	Signal Co (TOE 11-537A)	Ord Co (TOE 9-97A)	Engr Fld Maint Co (TOE 5-157)	Quarter- master Co (TOE 10-277A)	Trans Harbor Cft Co (TOE 55-9A)	3 Amphib Spt Regts (ea) (TOE 20-511)*	Trans Boat Maint Bn (TOE 55-555A)*
27	E Shop equipment, motorized, electrical repair.....	1			1				
28	E Shop equipment, motorized, general purpose repair.....	15			3			1	9
29	E Shop equipment, motorized, machine shop, heavy.....	4			1				3
30	E Shop equipment, motorized, small tool repair.....	1			1				
31	E Shop equipment, motorized, tool and bench.....	1			1				
32	E Shop equipment, motorized, Set No. 8, Welding.....	11			1				10
33	E tractor, crawler, diesel-driven, 29,000 to 32,000 tilt bulldozer.....	55						15	10
34	E Tractor, crawler, diesel-driven, 17,000 to 24,000 angle dozer.....	18						6	
35	E Trailer, 2W, utility, pole type, raft or bridge equipment.....	18						6	
36	E Trailer, 4W, tandem, 10-ton flat-bed, crane-shovel attach.....	24						8	
37	E Water purification equipment, Set No. 3, 35 GPM.....	6						2	
38	E Welding equipment, Set No. 1, electric, 300 amp, trailer-mounted.....	28			3			7	4
39	E Welding equipment, Set No. 2, oxyacetylene.....	15						4	3
40	E Welding equipment, Set No. 3, under water, oxy arc cutting.....	1							1
41	O Semitrailer, 6-ton, 2W, van.....	6			6				
42	O Trailer, ¼-ton, 2W, cargo.....	125	14	13	8	5	6	24	7
43	O Trailer, ¾-ton, 2W, cargo.....	14	1	2			2	3	
44	O Trailer, 1½-ton, 2W, cargo.....	149	2	22	24	10	22	1	20
45	O Trailer, 1½-ton, 2W, water tank, 250 gal.....	36	1	1	1	1	1	9	4
46	O Trailer, 2-ton, 4W, generator, M18.....	5				2			3
47	O Truck, ¼-ton.....	200	18	16	8	5	6	24	7
48	O Truck, ¾-ton, ambulance.....	2	1						1
49	O Truck, ¾-ton, command.....	1					1		
50	O Truck, ¾-ton, cargo.....	49	2	6	3	5	3	9	4
51	O Truck, 2½-ton, amphibious.....	45						12	9

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52	O Truck, 2½-ton, cargo.....	195	3	20	22	6	23	1	34	12
53	O Truck, 2½-ton, Sig Corps Repair.....	2		2						
54	O Truck, 2½-ton, shop van.....	5			5					
55	O Truck, 5-ton, dump.....	90							30	
56	O Truck, 5-ton, medium wrecker.....	11			3	1			2	1
57	O Truck, 5-ton, tractor.....	5				4				1
58	O Truck, 10-ton, tractor.....	21							7	
59	T Aircraft, two-place, fixed wing, observation.....	1	1							
60	T Helicopter, utility.....	3	3							
61	T Barge, dock or liquid, 578-ton or 4,160-bbl., 120-ft.....	3						3		
62	T Barge, liquid cargo, diesel, 6,500-bbl., 182-ft.....	1						1		
63	T Boat, passenger and cargo, diesel, 65-ft.....	20						2	6	
64	T Boat, patrol, diesel, 37-ft.....	24							8	
65	T Boat, patrol, rescue, 63-ft.....	9							3	
66	T Boat, utility, diesel, 26-ft.....	4								4
67	T Crane, floating revolving, diesel-electric, 60-ton.....	1								1
68	T Landing craft, two engine diesel, 56-ft, Navy (LCM).....	390							129	9
69	T Sounding machine, 0-160 fathoms.....	6							2	
70	T Tug, harbor, diesel, 1,200 HP, 100-ft.....	1						1		
71	T Vessel, supply, diesel, 176-ft.....	1						1		

*Incl Med Det.

CHAPTER 2

PERSONNEL

Section I. GENERAL

19. General

This chapter provides personnel data for general staff officers on division, corps, army, communications zone sections, communications zone, and theater staffs within a theater of operations.

a. Section I outlines the contents of the chapter.

b. Section II enables the staff officer to estimate losses and the requirements for replacements in—

(1) *Combat zone forces of division size or greater both for short periods of a particular type of combat action and for longer periods containing a variety of types of action.*

(2) *The communications zone.*

(3) *Theaters of operation.* Two methods of varying accuracy are given. In each case, loss estimates are given for the unit concerned as a whole with breakdowns by branch of service.

c. Section III gives a basis for estimates of prisoners of war by giving experience data under varying conditions of World War II.

d. Section IV gives a basis for estimates of decorations and mail by giving experience data from World War II.

e. Section V guides the staff officer in making the internal arrangements of division, corps, and army headquarters.

Section II. LOSSES AND REPLACEMENTS*

20. General

A personnel loss is any reduction in the assigned strength of a unit. These losses are caused primarily by enemy action, disease, accidents, and administrative action. The rate of loss varies with the theater of operations, climate, terrain, condition and state of training of troops, type of activity, the enemy, and numerous other factors. Each division and corps has its own loss experience dependent upon its own situation. Loss rates by arm or service, and by military occupational specialty within corps and divisions vary with the amount of exposure

* Losses and strengths considered herein do not include Air Force personnel.

of the particular category of personnel to the various causes of losses.

a. Categories of Losses. Personnel losses result from three general categories—

(1) *Casualties.* Those losses incurred in action including—

(a) Killed in action.

(b) Died of wounds and injuries received in action.

(c) Wounded or injured in action.

(d) Missing in action or captured by the enemy.

(2) *Nonbattle losses.* These losses include—

(a) Dead, nonbattle.

(b) Missing, nonbattle.

(c) Evacuated sick and injured, nonbattle.

(3) *Administrative losses.* Attrition from this category is relatively small and dependent upon current administrative policies. These losses include—

(a) Transfers to other units, disciplinary barracks, etc.

(b) Absent without leave and desertion.

(c) Rotational personnel.

(d) Discharges.

b. Gross Losses. In addition to those killed, captured, or missing, gross losses include those evacuated to hospitals and dropped from the rolls of their units. In division, corps, and army units, any man evacuated to an evacuation hospital or general hospital is dropped from unit rolls and carried on the rolls of the Department of the Army Medical Holding Detachment and is not chargeable against the authorized theater strength. In the communications zone, men are dropped from unit rolls after they remain in hospitals over 90 days or when it is foreseen that they will be hospitalized in excess of 90 days.

c. Net Losses. Net losses are gross losses less those returned to duty within the theater. Net losses are computed only at theater level and are used as a basis for estimates of personnel required from the zone of interior to maintain theater strength.

d. Loss Experience. Factors and figures which appear in the tables of this section are based primarily upon World War II experience and will not apply necessarily during another war. For future planning, loss experience of past wars must be modified by evaluating new factors applicable to new conditions. As a war progresses, every echelon of command gradually builds up loss experience which more accurately reflects the current conditions. *It is emphasized that even the most complete and accurate figures relating to past wars should not be relied upon as valid for any future war.* With past experience as a basis, good judgment and sound knowledge of principles must be used to develop new experience tables applicable to new conditions.

Administrative losses are based on changing policies and are not adaptable to the establishment of loss tables based on past experience. For this reason, experience tables for administrative losses are not included in this manual.

21. Combat Zone Estimates

a. General. Personnel loss estimates at corps and division levels are used to anticipate the effect of losses on the tactical plan and to prepare for the handling of replacements within the commands. The estimates must answer three questions—the strength at any given time, the losses to be anticipated for a specific situation, and the distribution of these losses by arm or service and military occupational specialty. Combat estimates are of two types—short-period estimates (5 days or less), and long-period estimates (over 5 days). Estimates at army level are used for the same purposes as at corps and division levels. In addition, they are used as a basis for allocation of available replacements and to inform higher headquarters of anticipated replacement requirements. Army and Corps headquarters use both short-period estimates (5 days or less) and long-period estimates (over 5 days). Divisions normally use only short period estimates.

b. Factors. In calculating losses, there are two major factors to be considered—

- (1) Loss rates applicable to the specific situation are expressed as percent of strength or as number per thousand of average strength of any given period. In compilation and use of loss data, units whose loss rates are about the same because of similar operating conditions, are grouped together.
- (2) Loss rates are applied to the strength of the particular command under consideration. There are two different strengths used—
 - (a) *Authorized strength* is table of organization and equipment strength plus any additional personnel authorized by higher headquarters. Authorized strength is used in long-range planning and when the assigned strength is unknown or unstable.
 - (b) *Assigned strength* includes all personnel carried as assigned on the unit's roster. Assigned strength is used when known in long-period estimates if it differs materially from authorized strength and if it will remain stable during the estimate period.

c. Short-Period Estimates (periods not in excess of 5 days).

(1) *Daily personnel losses as percent of strength.* (Do not use this table for loss-estimate periods over 5 days).

	1	2	3	4	5	6	7	8	9	10
	General type of operations for the force as a whole	Front line divisions			Divisions in corps and army reserve			Nondivisional units corps, and army ¹		
1		Casualty per-centage	Nonbattle per-centage	Total per-cent-age	Casualty per-centage	Nonbattle per-centage	Total per-cent-age	Casualty per-centage	Nonbattle per-centage	Total per-cent-age
2	Covering, and security force action	0.9	0.3	1.2	0.3	0.3	0.6	0.3	0.1	0.4
	ATTACK:									
3	Meeting engagement	2.4	0.3	2.7	0.3	0.3	0.6	0.4	0.1	0.5
4	Of a position—1st day	3.8	0.3	4.1	0.4	0.3	0.7	0.5	0.1	0.6
5	Succeeding days	1.9	0.3	2.2	0.3	0.3	0.6	0.4	0.1	0.5
6	Of a fortified zone—1st day	6.3	0.3	6.6	0.5	0.3	0.8	0.7	0.1	0.8
7	Succeeding days	3.2	0.3	3.5	0.4	0.3	0.7	0.5	0.1	0.6
	DEFENSE:									
8	Meeting engagement	1.5	0.3	1.8	0.3	0.3	0.6	0.3	0.1	0.4
9	Of a position—1st day	1.9	0.3	2.2	0.3	0.3	0.6	0.4	0.1	0.5
10	Succeeding days	1.0	0.3	1.3	0.3	0.3	0.6	0.3	0.1	0.4
11	Of a zone—1st day	3.2	0.3	3.5	0.4	0.3	0.7	0.5	0.1	0.6
12	Succeeding days	1.6	0.3	1.9	0.3	0.3	0.6	0.4	0.1	0.5
13	Inactive situations ²	0.7	0.3	1.0	0.3	0.3	0.6	0.3	0.1	0.4
14	Pursuit	1.3	0.3	1.6	0.3	0.3	0.6	0.3	0.1	0.4
15	Retirement and delaying action	0.7	0.3	1.0	0.3	0.3	0.6	0.3	0.1	0.4

¹ Use divisional loss rates for units attached to a division.

² Forces in contact—neither side attacking.

(2) *Distribution of casualties by branch (divisions).*

	1	2	3	4
1	Branch	Infantry division (percentage)	Armored division (percentage)	Airborne division (percentage)
2	Infantry	93.0	62.0	85.6
3	Artillery	2.4	3.6	6.9
4	Armor	2.0	23.1	0
5	Engineers	1.5	3.3	3.9
6	All others	1.1	8.0	3.6

(3) *Distribution of infantry casualties by selected military occupational specialty within an infantry division.* The combat effectiveness of an infantry division is most seriously affected by the personnel losses of its nine infantry battalions. A total of 87.4 percent of the infantry casualties occur among riflemen and heavy weapons crewmen (and closely allied specialists) who constitute the larger portion of the infantry battalion's strength.

(4) *Distribution of nonbattle losses.* Nonbattle losses in each branch are in the same proportion to the total nonbattle losses as the strength of that branch is to the total strength of the unit.

(5) *Example.* Calculate the total losses of a front line infantry division in the first 3 days of the defense of a position and determine the number of infantry riflemen and heavy weapons crewmen who become casualties.

(a) *Total losses.*

Authorized strength of division (TOE).....	17,454
Assigned strength of division (assumed), beginning of first day.....	17,279
Losses, first day, defense of position ($2.2\% \times 17,279$ —(1) above, line 9, column 4).....	386
Assigned strength, end of first day.....	16,899
Losses, second day, defense of position ($1.3\% \times 16,899$ —(1) above, line 10, column 4).....	220
Assigned strength, end of second day.....	16,679
Losses, third day, defense of position ($1.3\% \times 16,679$ —(1) above, line 10, column 4).....	217
Assigned strength, end of third day.....	16,462
Total losses, 3 days ($386 + 220 + 217$).....	817

(b) *Casualties.*

First day, defense of position ($1.9\% \times 17,279$ —(1) above, line 9, column 2).....	328
Second day, defense of position ($1.0\% \times 16,899$ —(1) above, line 10, column 2).....	169
Third day, defense of position ($1.0\% \times 16,679$ —(1) above, line 10, column 2).....	167
Total casualties.....	664

(c) *Infantry casualties* ($93\% \times 664$ —(2) above, line 2, column 2).....

Infantry riflemen and heavy weapons crewmen casualties ($87.4\% \times 618$ —(3) above).....	540
---	-----

d. *Long-Period Estimates—Combat Zone* (periods in excess of 5 days).

(1) *Monthly personnel losses:*

	1	2	3
1	Troops	Casualties—percent per month	Nonbattle losses—percent per month
2	Infantry divisions in combat zone.....	10	8
3	Armored divisions in combat zone.....	8	7
4	Corps and army nondivisional troops in combat zones.....	1.25	3.0

(2) *Types of casualties as percent of total casualties.*

	1	2	3	4
1	Casualties	Infantry divisions percent	Armored divisions percent	Corps and army nondivisional units percent
2	Killed.....	16.5	18.0	16.0
3	Wounded.....	70.0	72.0	84.0
4	Captured and missing.....	13.5	10.0	Negligible

(3) *Distribution of losses by branch within divisions.* See c(2) and (4) above.

(4) *Distribution of casualties by branch within corps and larger units in the combat zone as percent of total casualties—*

	1	2
1	Branch	Percent
2	Infantry.....	81.9
3	Artillery.....	4.5
	Field.....	(3.6)
	Antiaircraft.....	(0.9)
4	Armor.....	6.6
5	Corps of Engineers.....	3.2
6	Army Medical Service.....	2.8
7	Signal Corps.....	0.2
8	Quartermaster Corps.....	0.1
9	Ordnance Corps.....	0.2
10	Transportation Corps.....	
11	Chemical Corps.....	0.3
12	Military Police Corps.....	0.1
13	Miscellaneous.....	0.1

Note. The percentage figures given in this table are the field force casualty distribution as reported through Machine Record Unit channels, European Theater of Operations, for the period 6 June 1944 through 31 March 1945. The figure for Armor combines the percentages originally reported as Armored Forces (2.9 percent), Tank Destroyer (1.4 percent), and Cavalry (2.3 percent). *In actual operations, the distribution of casualties by branch varies with the composition of the force, type of operation, etc.*

(5) *Distribution of nonbattle losses.* See c(4) above.

(6) *Example.* Calculate the number of replacements required to bring I Corps up to authorized strength and to maintain it at that strength in combat for 15 days, given—

	Authorized strength	Assigned strength
Three infantry divisions.....	52, 362	48, 173
One armored division.....	14, 650	13, 871
Corps nondivisional troops.....	28, 651	27, 000
Total corps.....	95, 663	89, 044

(a) *Replacements needed now.*

Authorized (75,665)—assigned (89,044)..... 6, 619

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(b) *Estimated losses, 15 days.*

Infantry divisions ((1) above line 2):

Casualties $\frac{1}{2} \times 10\% \times 52,362$ 2, 618Nonbattle losses $\frac{1}{2} \times 8\% \times 52,362$ 2, 094

One armored division ((1) above, line 3):

Casualties $\frac{1}{2} \times 8\% \times 14,650$ 586Nonbattle losses $\frac{1}{2} \times 7\% \times 14,650$ 513

Corps nondivisional troops ((1) above, line 4):

Casualties $\frac{1}{2} \times 1.25\% \times 28,651$ 179Nonbattle losses $\frac{1}{2} \times 3.0\% \times 28,651$ 430

Total losses for 15 days..... 6, 420

(c) *Total replacements required.*

Replacements needed now..... 6, 619

Losses for 15-day period..... 6, 420

Total..... 13, 039

e. *Special Estimates for Airborne Operations.*

- (1) Personnel losses for airborne forces establishing an airhead may be estimated by applying the applicable daily loss rates from the following table to the *assigned* strengths of the units actually committed in the airhead or en route thereto.

Note. Rates in this table are for planning purposes only. The rates for each airborne operation are different. The rates in this table are useful as a guide or for use in practicing estimate procedures.

Forces en route	First day (percentage)			Succeeding days ¹ (percentage)		
Parachute.....			2			
Assault aircraft ²			1.5			
Air landed ³			0.5			0.5
Forces in airhead	Percentages			Percentages		
	Nonbattle	Casualty	Total	Nonbattle	Casualty	Total
Airborne divisions and attached troops:						
Parachute.....	0.3	8	8.3	0.3	2	2.3
Assault aircraft.....	0.3	4	4.3	0.3	2	2.3
Air landed infantry division and attached troops.....	0.3	3.8	4.1	0.3	2	2.3
Corps troops (includes followup echelon).....	0.3	1	1.3	0.3	1	1.3
Followup echelons of divisions and attached troops.....	0.3	2	2.3	0.3	2	2.3

¹ Upon link up or when airhead is firmly established, rates and methods given in paragraph 21c or d, for an infantry division are applicable.

² Includes only those forces landed by assault aircraft during the assault phase.

³ Includes all units and echelons landed by air after the assault phase.

⁴ This rate applies for first day of offensive action.

- (2) *Example.* Calculate the number of losses which will be sustained by the 102d Airborne Division on D-day and D+1. Base departure time and H-hour are on D-day. Computations for followup and rear echelons are omitted from this example. Strength of the division plus attachments (128 attached personnel) echeloned as follows:

	<i>Strength</i>
102d Airborne Division.....	17, 616
Parachute element.....	(12, 214)
Assault aircraft element.....	(1, 639)
Followup and rear echelons.....	(3, 763)

En route

(a) Parachute $(12,214 \times 2\%)$	244
(b) Assault aircraft $(1,639 \times 1.5\%)$	25
(c) Total losses en route.....	269

Airhead—First Day

(a) Parachute $(12,214 - 244) \times 8.3\%$	994
(b) Assault aircraft $(1,639 - 25) \times 4.3\%$	69

(c) Total losses in airhead—first day.....	1, 063
--	--------

First day losses $(269 + 1,063)$ 1, 332

Airhead D+1 losses $(13,853 - 1,332) \times 2.3\%$ 288

TOTAL LOSSES D-DAY AND D+1 $(1,332 + 288)$ 1, 620

f. Special Estimates for Amphibious Operations.

- (1) Personnel losses for amphibious forces establishing a beachhead may be estimated by applying the applicable daily loss rates from the following table to the *assigned* strength of units actually committed in the beachhead or en route thereto.

Note. Rates in this table are for planning purposes only. The rates for each amphibious operation are different. The rates in this table are for use as a guide only or in practicing estimate procedure.

	1	2	3	4	5	6	7	8	9
1		Phase I— Forces en route		Phase II—Forces in beachhead					
2		Daily at sea ¹	land- ing	First day			Succeeding days ²		
3		Nonbat- tle and casualty (per- cent- age)	Casu- alty (per- cent- age)	Nonbat- tle (per- cent- age)	Casu- alty (per- cent- age)	Total ³ (per- cent- age)	Nonbat- tle (per- cent- age)	Casu- alty (per- cent- age)	Total ³ (per- cent- age)
4	Assault forces: ⁴								
	Divisions and attached troops...	0.5	1.3	0.3	5.3	5.6	0.3	1.5	1.8
5	Corps and army troops.....	0.5	1.0	0.3	3.0	3.3	0.3	1.0	1.3
6	Follow-up forces: ⁵								
	Divisions and attached troops...	0.5	0.5	-----	-----	-----	0.3	1.5	1.8
7	Corps and army troops.....	0.5	0.5	-----	-----	-----	0.3	1.0	1.3

¹ Rates in this column include both casualties and nonbattle losses en route and are distributed by arm or service in the same proportion to the total losses as the strength of each arm or service is to the strength of the total force being transported.

² After beachhead is secure and forces are building up for the breakout (phase III), the rates and methods given in c(1) or d(1) above are applicable. The rates in this table are applicable only until the beachhead is firmly established.

³ Losses are distributed as given in c(4) above for nonbattle losses; c(2) or d(4) above for casualties by arm or service; d(2) above for casualties by category (killed, wounded, captured, and missing).

⁴ Assault forces in this table are those units who make their landing in the face of enemy opposition at or near the beaches. For the purpose of computing total divisions rates, it was assumed that an assault division lands with two regimental combat teams (reinforced) abreast, followed by the reserve combat team and the remainder of the division.

⁵ Followup forces in this table include those landing over beaches secured by other friendly forces.

(2) *Example.* Calculate the total number of losses which will be sustained during an amphibious operation by I Corps on D-1, D-day, and D+1.

	<i>Assigned strength</i>
1st Infantry Division.....	16, 985
2d Infantry Division.....	16, 860
3d Infantry Division.....	16, 923
Nondivisional troops, assault echelon.....	12, 415
Nondivisional troops, follow-up echelon.....	27, 170
Total I Corps.....	90, 353

Total I Corps will sail on D-1 at *assigned* strength. On D-day the 1st and 2d Infantry Divisions will assault the beach with 2 regimental combat teams (reinforced) abreast in each division; 3d Infantry Division and nondivisional troops in followup echelon will land on D+1.

D-1:

(a) Losses at sea:

1. Assault divisions	
33,845 $\times$ 0.5% (table—col. 2, line 4).....	169
2. Nondivisional assault troops	
12,415 $\times$ 0.5% (table—col. 2, line 5).....	62
3. Followup division	
16,923 $\times$ 0.5% (table—col. 2, line 6).....	85
4. Nondivisional followup troops	
27,170 $\times$ 0.5% (table—col. 2, line 1).....	136
5. Total I Corps.....	452

D-day:

(b) Assault landing:

1. Assault divisions	
(33,845—169) $\times$ 1.3% (table—col. 3, line 4).....	438
2. Nondivisional assault troops	
(12,415—62) $\times$ 1% (table—col. 3, line 5).....	124

(c) Nonbattle losses:

1. Assault divisions	
(33,845—169—438) $\times$ 0.3% (table—col. 4, line 4).....	100
2. Nondivisional assault troops	
(12,415—62—124) $\times$ 0.3% (table—col. 4, line 5).....	37

(d) Casualties:

1. Assault divisions	
(33,845—169—438) $\times$ 5.3% (table—col. 5, line 4).....	1762
2. Nondivisional assault troops	
(12,415—62—124) $\times$ 3% (table—col. 5, line 5).....	367

(e) Losses at sea:

1. Followup division	
(16,923—85) $\times$ 0.5% (table—col. 2, line 6).....	84
2. Nondivisional followup troops	
(27,170—136) $\times$ 0.5% (table—col. 2, line 7).....	135

(f) Total I Corps D-day losses

(b) + (c) + (d) + (e)..... 3,047

D+1:

(g) Beachhead losses:

1. Assault divisions	
(33,845—169—438—100—1,762) $\times$ 1.8% (table—col. 9, line 4).....	566

2. Nondivisional assault troops	
(12,415—62—124—37—367)×1.3% (table—col. 9, line 5)-----	154
(h) Landing losses:	
1. Followup division	
(16,923—85—84)×0.5% (table—col. 3, line 6)---	84
2. Nondivisional followup troops	
(27,170—136—135)×0.5% (table—col. 3, line 7)---	134
(i) Beachhead losses:	
1. Followup division	
(16,923—85—84—84)×1.8% (table—col. 9, line 6)-----	300
2. Nondivisional followup troops	
(27,170—136—135—134)×1.3% (table—col. 9, line 7)-----	348
(j) Total I Corps D+1 losses	
(g)+(h)+(i)-----	1,586

(3) Work sheet form—personnel loss estimates—amphibious operations.

	1	2	3	4	5	6	7	8	9	10
1		D-1			D-day			D+1		
		Rate (per- centage)	Strength	Losses	Rate (per- centage)	Strength	Losses	Rate (per- centage)	Strength	Losses
2	Phase I—Forces at sea:									
3	Assault divisions.....	.5	35,400	177						
4	Nondivisional assault troops.....	.5	12,415	62						
5	Followup division.....	.5	17,702	89	0.5	17,613	88			
6	Nondivisional followup troops.....	.5	27,170	136	.5	27,034	135			
7	Landing:									
8	Assault divisions.....				1.3	35,223	458			
9	Nondivisional assault troops.....				1.0	12,353	124			
10	Followup division.....							0.5	17,525	88
11	Nondivisional followup troops.....							.5	26,899	134
12	Total—Phase I.....			464			805			222
13	Phase II—Forces in beachhead:									
14	Assault divisions:									
15	Nonbattle losses.....				.3	34,765	104	1.8	32,818	591
16	Casualties.....				5.3	34,765	1,843			
17	Nondivisional assault troops:									
18	Nonbattle losses.....				.3	12,229	37	1.3	11,825	154
19	Casualties.....				3.0	12,229	367			
20	Followup division.....							1.8	17,437	314
21	Nondivisional followup troops.....							1.3	26,765	348
22	Total—Phase II.....						2,351			1,407

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22. Communications Zone Estimates

In estimating the gross losses for all ground troops in the communications zone, casualties are considered negligible, and nonbattle losses are calculated at 0.5 percent per month. Arm or service distribution of nonbattle losses is determined by applying this nonbattle loss percentage to the strength of each arm or service in the command considered.

23. Theater Estimates

a. Gross Losses.

(1) *First method.* This method is more accurate than (2) below because of frequent changes in organization within a theater.

(a) Determine casualties and nonbattle losses of combat zone troops (par. 21).

1. Divisional.

2. Nondivisional.

(b) Determine nonbattle losses of troops in the communications zone (par. 22).

(c) Add (a) and (b) above.

(2) *Second method.* This method is quicker than (1) above and can be used in a well-established theater, remembering that loss rates are different in various theaters, and within the theater are influenced by different climatic and geographic conditions, enemy resistance, and the nature of current operations.

(a) Apply the following loss rate percentages to the total theater ground strength:

1		2
1	Type of loss	Percent of total theater strength per month
2	Nonbattle losses.....	4.20
3	Casualties.....	4.08
4	Killed.....	(0.60)
5	Wounded.....	(3.00)
6	Captured and missing.....	(0.48)

(b) Distribution of casualties by type and by branch:

Note. This distribution is based on United States Army experience in World War II in all theaters. *Approximately 6½ percent of the losses were officers.* Percentages for Armor given below are composite figures grouping cavalry and armored force percentages. *In actual operations the distribution of casualties by arm or service varies with the composition of the theater, types of operations, etc.*

	1	2	3	4	5	6
1	Branch	Percent of branch's casualties by type				
		Killed	Wounded	Missing	Captured	Total
2	Infantry.....	17.3	71.2	2.8	8.7	100.0
3	Artillery.....	14.3	61.6	3.1	21.0	100.0
	Field.....	(15.7)	(68.0)	(2.7)	(13.6)	(100.0)
	Antiaircraft.....	(10.5)	(43.8)	(4.1)	(41.6)	(100.0)
4	Corps of Engineers.....	18.8	66.9	2.6	11.7	100.0
5	Army Medical Service.....	15.3	66.4	2.9	15.4	100.0
6	Armor.....	19.0	70.8	1.7	8.5	100.0
7	Signal Corps.....	17.2	55.5	4.5	22.8	100.0
8	Quartermaster Corps.....	18.6	42.9	6.6	31.9	100.0
9	Ordnance Corps.....	16.1	43.4	5.7	34.8	100.0
10	Transportation Corps.....	24.1	69.2	5.9	0.8	100.0
11	Chemical Corps.....	22.7	65.3	1.3	10.7	100.0
12	Military Police Corps.....	18.1	71.6	1.3	9.0	100.0
13	Miscellaneous.....	18.8	36.8	13.6	30.8	100.0
14	Total.....	17.2	69.8	2.8	10.2	100.0

1	Branch	Percent of each type of casualty by branch				
		Killed	Wounded	Missing	Captured	Total
2	Infantry.....	80.9	82.0	79.5	68.5	80.5
3	Artillery.....	5.9	6.3	7.6	14.6	7.1
	Field.....	(4.8)	(5.1)	(4.9)	(6.9)	(5.2)
	Antiaircraft.....	(1.1)	(1.2)	(2.7)	(7.7)	(1.9)
4	Corps of Engineers.....	4.0	3.5	3.3	4.2	3.6
5	Army Medical Service.....	2.6	2.8	2.9	4.4	2.9
6	Armor.....	3.8	3.6	2.1	2.9	3.5
7	Signal Corps.....	0.5	0.4	0.8	1.1	0.5
8	Quartermaster Corps.....	0.6	0.4	1.4	1.8	0.6
9	Ordnance Corps.....	0.4	0.2	0.8	1.4	0.4
10	Transportation Corps.....	0.2	0.1	0.3	0.0	0.1
11	Chemical Corps.....	0.6	0.4	0.2	0.4	0.4
12	Military Police Corps.....	0.2	0.2	0.1	0.1	0.2
13	Miscellaneous.....	0.3	0.1	1.0	0.6	0.2
14	Total.....	100.0	100.0	100.0	100.0	100.0

(c) Distribution of nonbattle losses is in direct proportion to percentage strength of each branch.

b. Returns to Duty Within the Theater.

- (1) Returns to duty within the theater from hospitals as percent of hospital admissions.

1	1	2	3	4	5
	Days after admission	Within time period		Cumulative at end of period	
		Casualty	Nonbattle	Casualty	Nonbattle
2	0-15.....	15.3	61.0	15.3	61.0
3	15-30.....	15.2	20.7	30.5	81.7
4	30-45.....	11.7	4.5	42.2	86.2
5	45-60.....	8.5	4.4	50.7	90.6
6	60-75.....	5.2	1.2	55.9	91.8
7	75-90.....	3.6	1.2	59.5	93.0
8	90-105.....	2.7	0.2	62.2	93.2
9	105-120.....	2.6	0.2	64.8	93.4

Source: ETO, GFRG History 1944-45.

- (2) *Returns to duty from captured and missing status.* Approximately 30 percent of the personnel losses in this category during any given month are recovered for duty within the theater during the same month. Returns to duty from captured and missing status in succeeding months is indeterminable and should be disregarded in making estimates.

- (3) *Limited assignment personnel.* Of the personnel who return to duty within the theater from hospitals, the following percentages are limited assignment:

- (a) Under 30-day or 60-day evacuation policies:

8 percent of the casualties.

5 percent of the nonbattle losses.

- (b) Under 90-day or 120-day evacuation policies:

28.6 percent of the casualties.

5.3 percent of the nonbattle losses.

c. Net Losses. Theater net losses for any specified period equal the difference between the theater gross losses for the same period and the personnel who return to duty within the theater during the same period.

d. Theater Tables.

- (1) The factors in the following tables are *per 1,000 of theater strength*. They were calculated on the basis of—

- (a) Returns to duty within the theater from hospitals as given in *b(1)* above.

- (b) Returns to duty within the theater from captured and missing status as given in *b(2)* above.

(c) Loss rates in each category as follows:

1. Disease and nonbattle injuries—

1 per 1,000 per day

2. Battle injuries (including killed in action (KIA) and wounded in action (WIA))—

1.2 per 1,000 per day

WIA=1.0 per 1,000 per day

$$\frac{\text{KIA}}{\text{WIA}} = \frac{1}{5}$$

KIA=.2 per 1,000 per day

WIA+KIA=1.2 per 1,000 per day

3. Captured and missing—

1 per 1,000 per day

In any theater of operations where returns to duty experience varies from that given in b(1) or (2) above or where the ratio of KIA to WIA is not 1:5, these tables would require revision to reflect the different basic data.

(2) *Only the losses which occur during the period starting with the first day of the tables have been considered in the derivation of the factors. The changes in net losses or returns to duty within the theater resulting from losses which occur prior to the date starting with the first day of the tables must be computed separately.*

(3) *Cumulative gross loss factors.*

Note. This table is prepared by multiplying the rates given in paragraph (1) above by the number of days in the period under consideration. For fractional periods of a month, use the proportional part of the monthly factor, thus for 10 days, use 10/30 of the 30-day factor.

	1	2	3	4	5	6	7	8
1	Type of loss	30 days	60 days	90 days	120 days	150 days	180 days	360 days
2	Disease and nonbattle injuries ¹	30	60	90	120	150	180	360
3	Casualties:							
	a. Captured and missing.....	30	60	90	120	150	180	360
	b. Other casualties ²	36	72	108	144	180	216	432

¹ This category includes hospital cases, deaths, and admissions sent to the zone of interior.

² This category includes hospital cases, killed in action, died in hospital, and admissions sent to the zone of interior.

(4) *Basic graphs for the derivation of factors.*

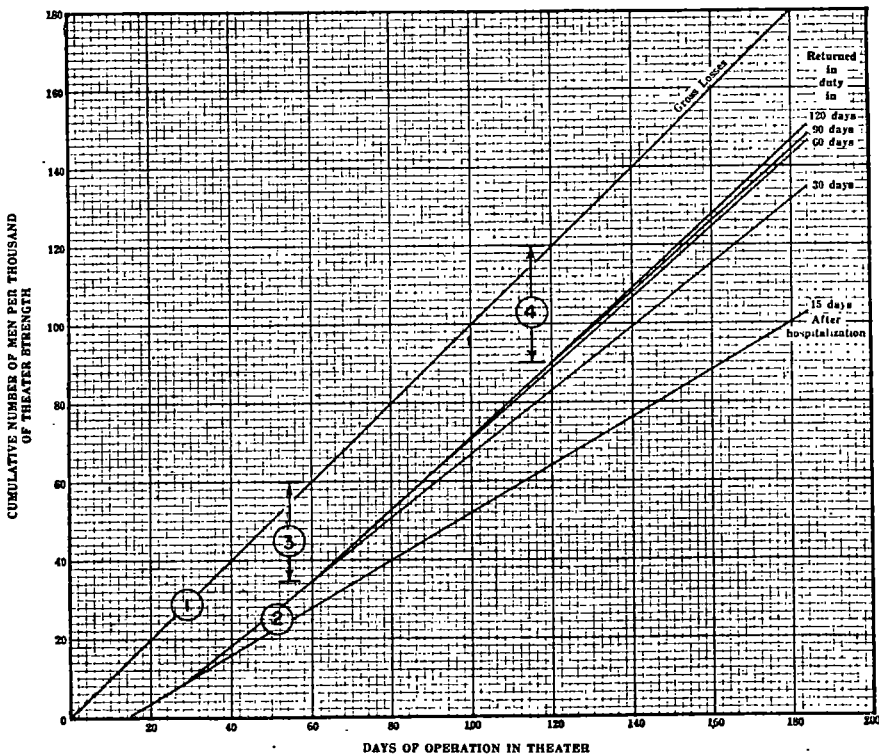
(a) Cumulative net loss factors contained in the tables of (5) below are derived from the graphs in (d), (e), and (f) below.

(b) Basic data for construction of the gross loss lines ① on the

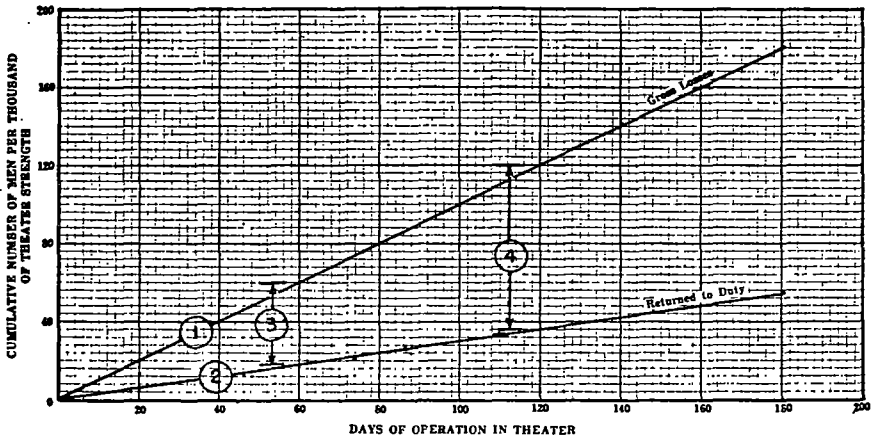
graphs were taken from (3) above. Basic data for construction of "returns to duty" lines ② were taken from b(1) and (2) above.

- (c) Factors contained in (5) (a), (b), (c), and (d) below were determined by measuring the length or ordinate between the gross line and the returns to duty line corresponding to the evacuation policy considered (30-, 60-, 90-, and 120-day evacuation policy) at 30-day intervals. Thus, measurement ③ is the source of the factors in (5) below, column 3, and measurement ④ is the source of the factors in (5)(c) below, column 5. (Slight variations between those figures taken from the graphs and those given in the table are due to the fact that figures in the table were based on more complete data giving the percent returned to duty within the theater from hospitals at 5-day intervals rather than 15-day intervals as given in b(1) above.)

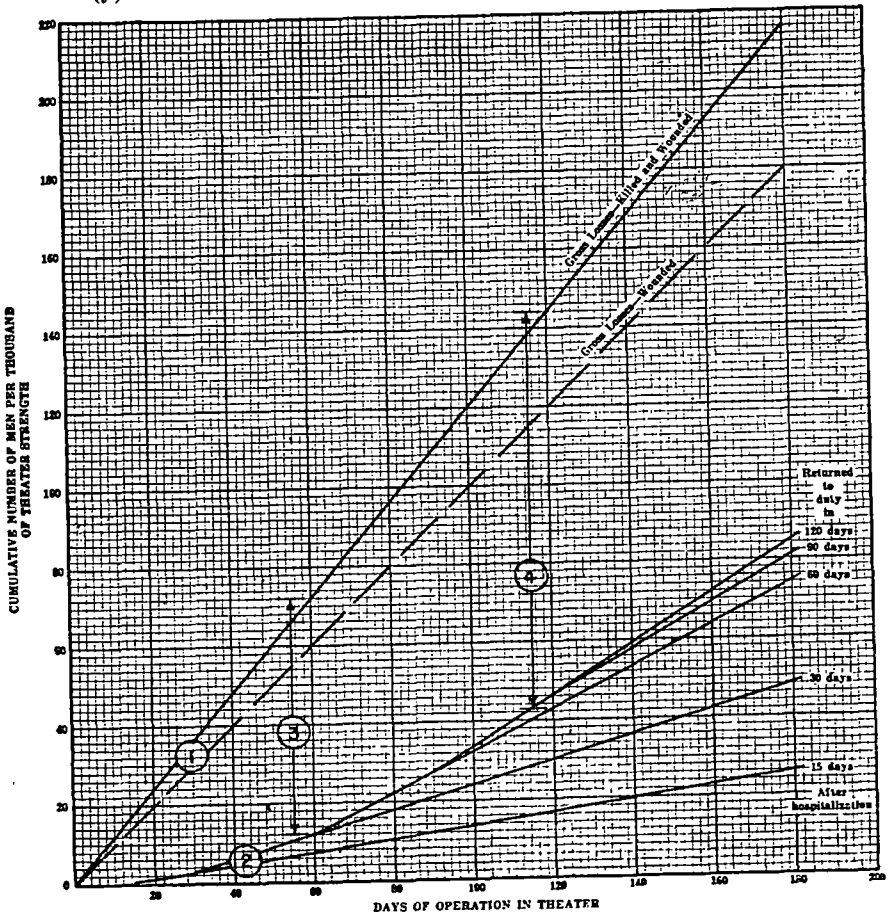
- (d) *Disease and nonbattle injuries.*



(e) Casualties—captured and missing.



(f) Casualties—other than captured and missing.



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(5) *Net loss factors.* (For fractional periods of a month, use the proportional part of the monthly factor; thus for 10 days, use 10/30 of the 30-day factor.)

Cumulative ¹									Monthly ²						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Type of loss	30 days	60 days	90 days	120 days	150 days	180 days	360 days	1-30 days	30-60 days	60-90 days	90-120 days	120-150 days	150-180 days	330-360 days

(a) *120-day evacuation policy.*

2	Disease and nonbattle injuries ³ -----	15.2	21.8	25.6	28.7	31.8	34.9	53.5	15.2	6.6	3.8	3.1	3.1	3.1	3.1
3	Casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other casualties ⁴	30.3	56.0	76.8	95.2	113.0	130.8	237.6	30.3	25.7	20.8	18.4	17.8	17.8	17.8

(b) *90-day evacuation policy.*

2	Disease and nonbattle injuries-----	15.2	21.8	25.6	28.8	32.0	35.2	54.4	15.2	6.6	3.8	3.2	3.2	3.2	3.2
3	Casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other casualties ⁴	30.3	56.0	76.8	96.0	115.2	134.4	249.6	30.3	25.7	20.8	19.2	19.2	19.2	19.2

(c) *60-day evacuation policy.*

2	Disease and nonbattle injuries ³ -----	15.2	21.8	25.6	29.4	33.2	37.0	59.8	15.2	6.6	3.8	3.8	3.8	3.8	3.8
3	Casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other casualties ⁴	30.3	56.2	78.0	99.8	121.6	143.4	274.2	30.3	25.9	21.8	21.8	21.8	21.8	21.8

(d) *30-day evacuation policy.*

2	Disease and nonbattle injuries ³ -----	15.2	21.8	28.4	35.0	41.6	48.2	87.8	15.2	6.6	6.6	6.6	6.6	6.6	6.6
3	Casualties:														
	a. Captured and missing-----	21.0	42.0	63.0	84.0	105.0	126.0	252.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0
	b. Other casualties ⁴	30.3	58.2	86.1	114.0	141.9	169.8	337.2	30.3	27.9	27.9	27.9	27.9	27.9	27.9

¹ The factors for this section of the table are derived from the graphs in (4) above by subtracting the ordinate of cumulative returns to duty line for each recovery period (30-, 60-, 90-, 120-day evacuation policy) at 30-day intervals from the corresponding ordinate of the cumulative gross line at the same intervals.

² The tabular values for this section of the table are derived from the cumulative net loss factors by subtracting the cumulative net loss factor at the end of each period from the cumulative net loss factor at the end of the next period.

³ This category includes hospital cases, deaths, and admissions sent to the zone of interior.

⁴ This category includes hospital cases, killed in action, died in hospital, and admissions sent to the zone of interior.

- (6) *Returns to duty factors.* (For fractional periods of a month, use the proportional part of the monthly factor; thus for 10 days, use 10/30 of the 30-day factor.)

Cumulative ¹								Monthly ²							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		30 days	60 days	90 days	120 days	150 days	180 days	360 days	1-30 days	30-60 days	60-90 days	90-120 days	120-150 days	150-180 days	330-360 days
1	Type of loss														

(a) *120-day evacuation policy.*

2	Disease and nonbattle injuries.....	14.8	38.2	64.4	91.3	118.2	145.1	306.5	14.8	23.4	26.2	26.9	26.9	26.9	26.9
3	Casualties:														
	a. Captured and missing.....	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other casualties..	5.7	16.0	31.2	48.8	67.0	85.2	194.4	5.7	10.3	15.2	17.6	18.2	18.2	18.2

(b) *90-day evacuation policy.*

2	Disease and nonbattle injuries.....	14.8	38.2	64.4	91.2	118.0	144.8	305.6	14.8	23.4	26.2	26.8	26.8	26.8	26.8
3	Casualties:														
	a. Captured and missing.....	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other casualties..	5.7	16.0	31.2	48.0	64.8	81.6	182.4	5.7	10.3	15.2	16.8	16.8	16.8	16.8

(c) *60-day evacuation policy.*

2	Disease and nonbattle injuries.....	14.8	38.2	64.4	90.6	116.8	143.0	300.2	14.8	23.4	26.2	26.2	26.2	26.2	26.2
3	Casualties:														
	a. Captured and missing.....	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other casualties..	5.7	15.8	30.0	44.2	58.4	72.6	157.8	5.7	10.1	14.2	14.2	14.2	14.2	14.2

(d) *30-day evacuation policy.*

2	Disease and nonbattle injuries.....	14.8	38.2	61.6	85.9	108.4	131.8	155.2	14.8	23.4	23.4	23.4	23.4	23.4	23.4
3	Casualties:														
	a. Captured and missing.....	9.0	18.0	27.0	36.0	45.0	54.0	108.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
	b. Other casualties..	5.7	13.8	21.9	30.0	38.1	46.2	95.0	5.7	8.1	8.1	8.1	8.1	8.1	8.1

¹ The cumulative factors for this table are derived by subtracting the cumulative net loss factor from (5) above from the cumulative gross loss factor for the same period from (3) above. They may be derived directly from the graphs in (4) above.

² The monthly factors for this table are derived by subtracting the cumulative returns to duty factor at the end of each period from the cumulative factor at the end of the next period.

(7) *Returns to duty within the theater of the losses occurring in any given month.*

Note. The factors for this table are derived from the monthly returns to duty factors given in (6) above by subtracting from the monthly factor for each month the monthly factor for the preceding month.

	1	2	3	4	5	6
1	Losses occurring in any given month returned to duty in.	Same month.	1st following month.	2d following month.	3d following month.	4th following month.

(a) *120-day evacuation policy.*

2	Disease and nonbattle injuries.....	14.8	8.6	2.8	0.7	0
3	Casualties:					
	a. Captured and missing.....	9.0	0.	0	0	0
	b. Other casualties.....	5.7	4.6	4.9	2.4	0.6

(b) *90-day evacuation policy.*

2	Disease and nonbattle injuries.....	14.8	8.6	2.8	0.6	0
3	Casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other casualties.....	5.7	4.6	4.9	1.6	0

(c) *60-day evacuation policy.*

2	Disease and nonbattle injuries.....	14.8	8.6	2.8	0	0
3	Casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other casualties.....	5.7	4.4	4.1	0	0

(d) *30-day evacuation policy.*

2	Disease and nonbattle injuries.....	14.8	8.6	0	0	0
3	Casualties:					
	a. Captured and missing.....	9.0	0	0	0	0
	b. Other casualties.....	5.7	2.4	0	0	0

(8) *Theater daily loss rates.*

(a) The tables given in (5), (6), and (7) above were computed on the basis of the *assumed* loss rates given in (1) above (1 per 1,000 of strength per day with adjustment for killed in action (KIA)). They must be modified to reflect the actual average daily loss experience of each theater. Thus, in a particular theater, the hospital admission rates for disease and nonbattle injury or for wounds may be higher or lower than 1 per 1,000 per day; and the captured and

missing rate may be higher or lower than 1 per 1,000 per day.

- (b) The table in (c) below reflects daily loss rates (per 1,000 of theater army strength) which correspond to average experience in all theaters in World War II. This table is provided for planning purposes, and for use in training and other situations where actual theater experience is not available.

- (c) Theater daily loss rates per thousand per day. These daily loss rates correspond to the monthly rates given in a(2)(a) above.

	1	2
1	Type of loss	Rate per 1,000 per day
2	Disease and nonbattle injuries.....	1.4
3	Casualties:	
	a. Captured and missing.....	0.16
	b. Other casualties.....	1.0

- (9) *Formula.*

- (a) The formula $R \times T \times S$ is used in computing theater estimates.

1. R = Theater daily loss rate per 1,000 per day ((8)(c) above).

2. T = Factor from appropriate table ((3) above for gross losses, (5) above for net losses, (6) above for returns to duty, (7) above for returns to duty of losses occurring in any given month).

3. S = Theater army strength in thousands.

- (b) The formula is set up and solved for each type of loss separately. Theater totals are obtained by adding the results of the computations for each type of loss.

e. *Example.* Given a theater army strength of 2,000,000, a 60-day evacuation policy, and theater daily loss rates as shown in (8)(c) above, make the following theater estimates for losses occurring during the next 60 days.

- (1) Gross losses (d(3), (8)(c), and (9) above).

- (a) Cumulative for 60 days.

1. Disease and nonbattle injuries ($1.4 \times 60 \times 2,000$) - 168, 000

2. Casualties:

(a) Captured and missing ($0.16 \times 60 \times 2,000$) - 19, 200

(b) Other casualties ($1.0 \times 72 \times 2,000$) - 144, 000

3. Total - 331, 200

- (b) First 30 days.

1. Disease and nonbattle injuries ($1.4 \times 30 \times 2,000$)	84, 000
2. Casualties:	
(a) Captured and missing ($0.16 \times 30 \times 2,000$)	9, 600
(b) Other casualties ($1.0 \times 36 \times 2,000$)	72, 000

3. Total..... 165, 600

(c) Second 30 days.

(Same as (b) above)..... 165, 600

Note. This computation could have been made by use of table given in a(2)(a) above.

(2) Returns to duty within the theater (d(6), (8), and (9) above).

(a) Cumulative for 60 days.

1. Disease and nonbattle injuries ($1.4 \times 38.2 \times 2,000$)..... 106, 960

2. Casualties:

 (a) Captured and missing ($0.16 \times 18 \times 2,000$)..... 5, 760

 (b) Other casualties ($1.0 \times 15.8 \times 2,000$)..... 31, 600

3. Total..... 144, 320

(b) First 30 days.

1. Disease and nonbattle injuries ($1.4 \times 14.8 \times 2,000$)..... 41, 440

2. Casualties:

 (a) Captured and missing ($0.16 \times 9 \times 2,000$)..... 2, 880

 (b) Other casualties ($1.0 \times 5.7 \times 2,000$)..... 11, 400

3. Total..... 55, 720

(c) Second 30 days.

1. Disease and nonbattle injuries ($1.4 \times 23.4 \times 2,000$)..... 65, 520

2. Casualties:

 (a) Captured and missing ($0.16 \times 9 \times 2,000$)..... 2, 880

 (b) Other casualties ($1.0 \times 10.1 \times 2,000$)..... 20, 200

3. Total..... 88, 600

(3) Net losses (c and d(5), (8), and (9) above).

(a) Cumulative for 60 days.

1. Disease and nonbattle injuries ($1.4 \times 21.8 \times 2,000$)..... 61, 040

2. Casualties:

 (a) Captured and missing ($0.16 \times 42 \times 2,000$)..... 13, 440

 (b) Other casualties ($1.0 \times 56.2 \times 2,000$)..... 112, 400

3. Total..... 186, 880

(b) First 30 days.

1. Disease and nonbattle injuries ($1.4 \times 15.2 \times 2,000$).....	42, 560
---	---------

2. Casualties:

(a) Captured and missing ($0.16 \times 21 \times 2,000$).....	6, 720
---	--------

(b) Other casualties ($1.0 \times 30.3 \times 2,000$).....	60, 600
--	---------

3. Total.....	109, 880
---------------	----------

(c) Second 30 days.

1. Disease and nonbattle injuries ($1.4 \times 6.6 \times 2,000$).....	18, 480
--	---------

2. Casualties:

(a) Captured and missing ($0.16 \times 21 \times 2,000$).....	6, 720
---	--------

(b) Other casualties ($1.0 \times 25.9 \times 2,000$).....	51, 800
--	---------

3. Total.....	77, 000
---------------	---------

Section III. PRISONER OF WAR CAPTURE RATES

24. General

In order that the necessary arrangements may be made for the reception, care, and disposition of prisoners of war, it will be necessary to estimate the number of prisoners that probably will be captured over a period of time or for a specific operation. Factors to be considered in preparing such an estimate include the following:

a. Enemy morale.

b. Avenues of withdrawal open to the enemy.

c. Ability of friendly forces to encircle or cut off enemy units.

d. Type of warfare in which forces are engaged; that is, position warfare, war of movement, etc.

e. Relative strength of opposing forces.

f. Intensity and effectiveness of friendly psychological warfare.

g. Effectiveness of ideological indoctrination of enemy troops.

25. Division and Corps Estimate

a. *Equal Force Estimates.* When the opposing forces are approximately equal in number, the average number of prisoners expected to be taken can be estimated by using the factors listed below.

Troops	Percentage per month of strength
Armored divisions.....	. 8
Infantry divisions.....	1. 35
Corps and army nondivisional units.....	negligible

b. *Unequal Force Estimates.* For estimates by divisions (or task forces) and corps, the following figures are averages, based on experiences of some United States divisions against veteran troops in World

War II. In these instances, United States forces were numerically superior by about two to one—

By a division in attack of a defensive position-----	50 per day.
By a division in attack of a defensive position preceded by night approach and with complete surprise obtained.	700 per day.
By an armored task force in an encirclement operation--	1,000 per day.
By a division in defense of a position against an unsuccessful attack.	300 per day.
By a corps in an action of 25 days against a determined enemy.	4,680 in 25 days.
(Expressed as an average number of prisoners per corps per day.)	187 per day.
(Expressed as an average number of prisoners per division per day.)	47 per day.

Note. The percentages and figures shown in *a* and *b* above may be used when estimating prisoners of war expected to be taken by either friendly or the enemy forces.

26. Theater Estimates

For overall estimates on a theater level, the following factor may be used: in a major war, the average daily rate for captured may be estimated at approximately 0.14 per 1,000. Hence, for an enemy force of 1,000,000 the average daily number of prisoners captured may be estimated at 140. As prisoners are not captured at a uniform rate, special preparations must be made for the reception of unusual numbers when theater plans contemplate decisive action, such as cutting routes of withdrawal or driving the enemy against an obstacle.

27. World War II Capture Rates

The following figures were taken from available after-action reports and are presented for information purposes only:

	<i>Average daily capture rate per division</i>	<i>Total number of P W captured</i>
<i>a.</i> 12th Army Group, Europe (36 divisions plus attached troops)—		
Period: 1 Nov. 44 to 29 Feb. 45 (120 days)-----	37	161, 330
Period: 1 Mar. 45 to 30 Apr. 45 (60 days)-----	307	1, 328, 875
<i>b.</i> Fifth Army, Italy (6 divisions plus attached troops)—		
Period: 9 Sep. 43 to 15 Dec. 44 (456 days)-----	16	44, 473
<i>c.</i> Tenth Army, Okinawa (4 Army and 2 Marine divisions)—		
Period: 1 Apr. 45 to 7 Jul. 45 (98 days)-----	18	10, 864
<i>d.</i> Fourteen armored divisions, Europe (average number of days of combat per division, 133)—		
Period: 6 Jun. 44 to 8 May 45 (338 days)-----	1, 139	832, 824

Section IV. PERSONNEL SERVICES

28. General

The data presented in paragraphs 29 and 30 are intended for planning purposes only, and do not represent doctrine. The figures have been compiled from the experience of the European Theater of Operations in World War II by averaging the experience of several units over several periods of time. The figures are based on the needs per month of 10,000 troops, except where otherwise noted.

29. Decorations

	<i>Number</i>
Distinguished-Service Cross.....	11
Distinguished-Service Medal (per campaign).....	1
Silver Star.....	107
Legion of Merit (per campaign).....	13
Bronze Star (heroism).....	236
Bronze Star (Meritorious achievement, per campaign).....	160

30. Mail

a. Surface.

	<i>Pieces</i>	<i>Weight in pounds</i>	<i>M/tons of shipping space</i>
(1) Incoming (to the theater):			
First class.....	97, 450	2, 250	4. 500
Other.....	26, 650	49, 754	99. 508
(2) Outgoing:			
First class.....	54, 973	1, 270	2. 540
Other.....	1, 436	2, 675	5. 350

b. Air.

(1) Incoming (to the theater):			
Air mail.....	171, 000	3, 970	7. 940
V-mail.....	94, 083	25. 7	. 0514
(2) Outgoing:			
Air mail.....	120, 066	2, 790	5. 580
V-mail.....	85, 483	23. 3	. 0466

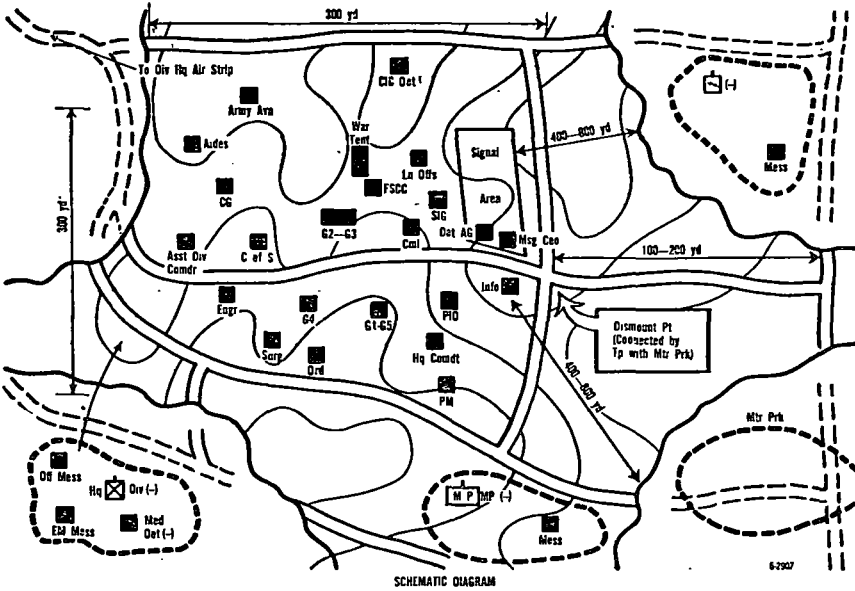
Section V. INTERNAL ARRANGEMENT OF HEADQUARTERS

31. General

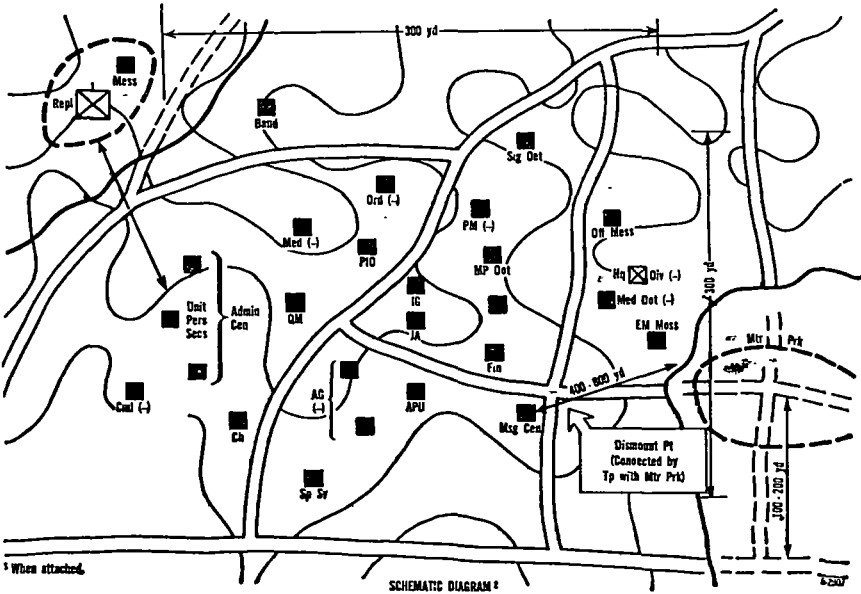
The following diagrams indicate schematic arrangements for army, corps, and division headquarters. The echelons of army and corps headquarters generally are located in buildings. The diagrams which are shown for these headquarters suggest a layout to be followed in the event they operate under tentage.

32. Division Headquarters

a. Forward Echelon (not to scale).



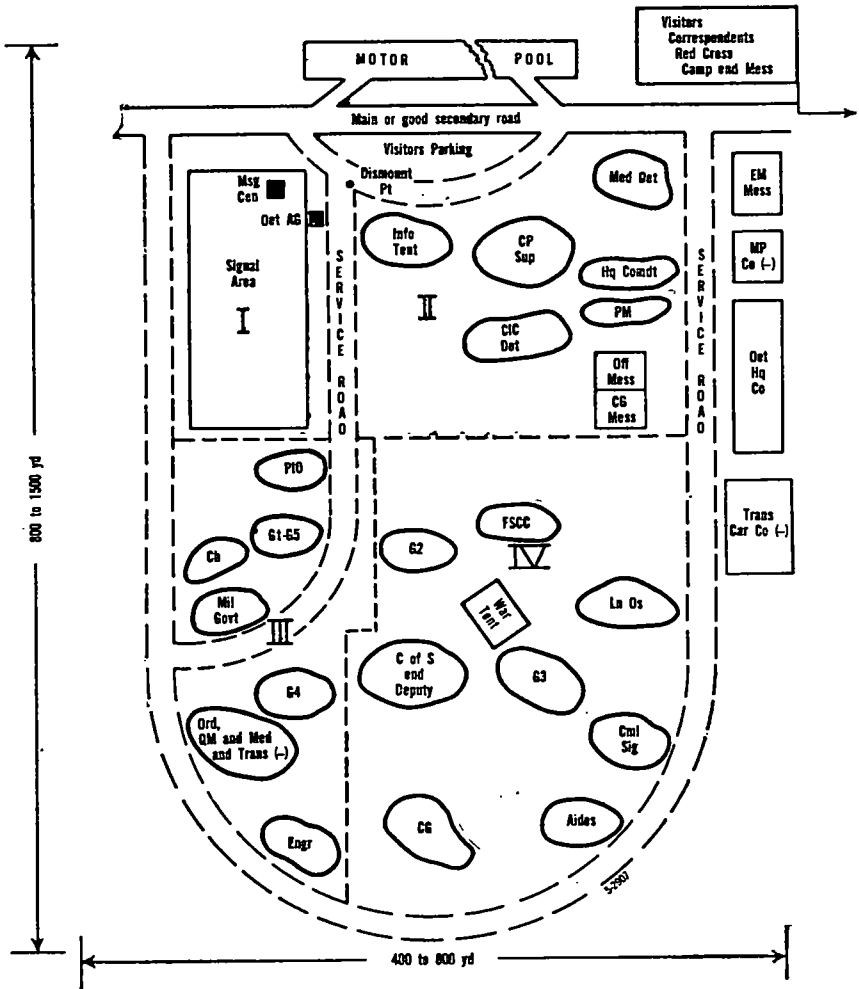
b. Rear Echelon (not to scale).



* This diagram is more applicable to the infantry division. In the armored division, the rear echelon is normally located in the division trains area.

33. Corps Headquarters

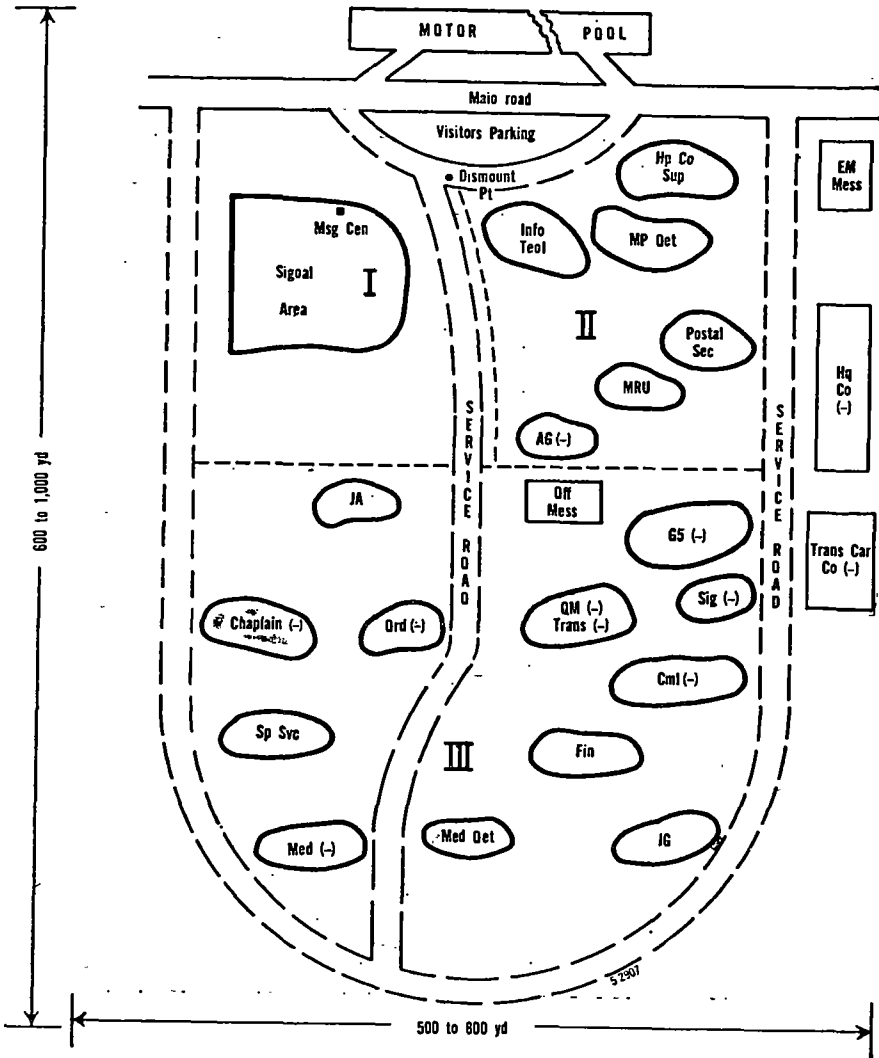
a. *Forward Echelon* (not to scale).



Relative locations of Sections at Corps Command Post.

Notice that the total area occupied is divided generally into four quadrants. Various sections should endeavor to retain their relative positions within their respective quadrants.

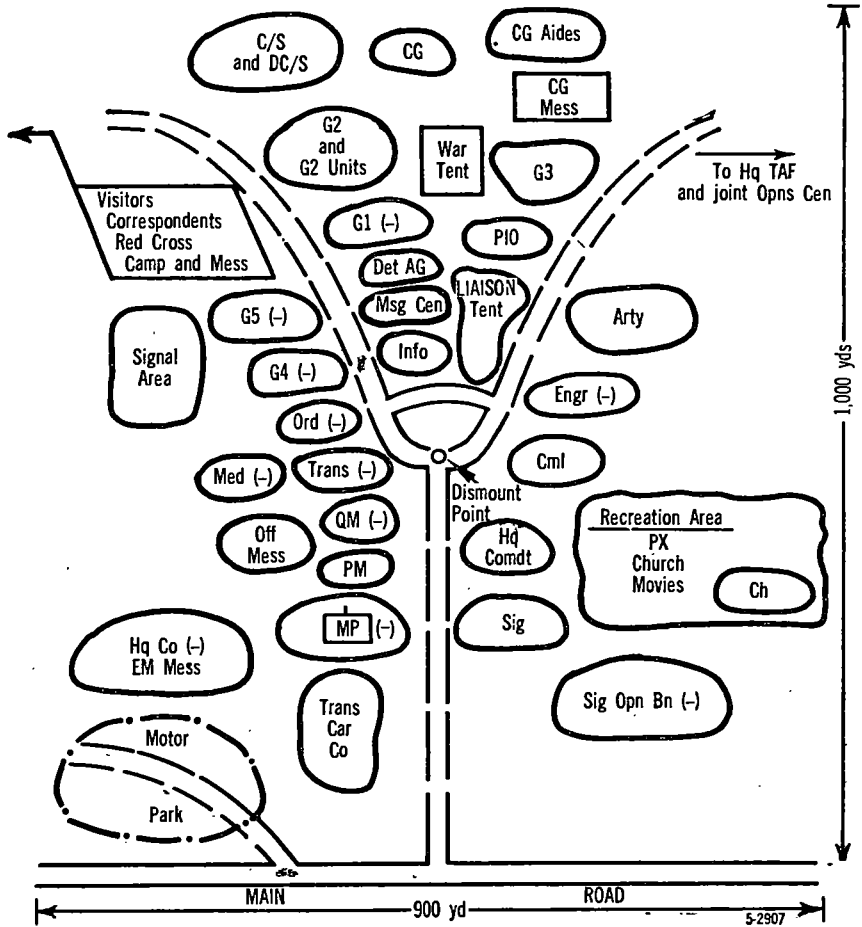
b. Rear Echelon (not to scale).



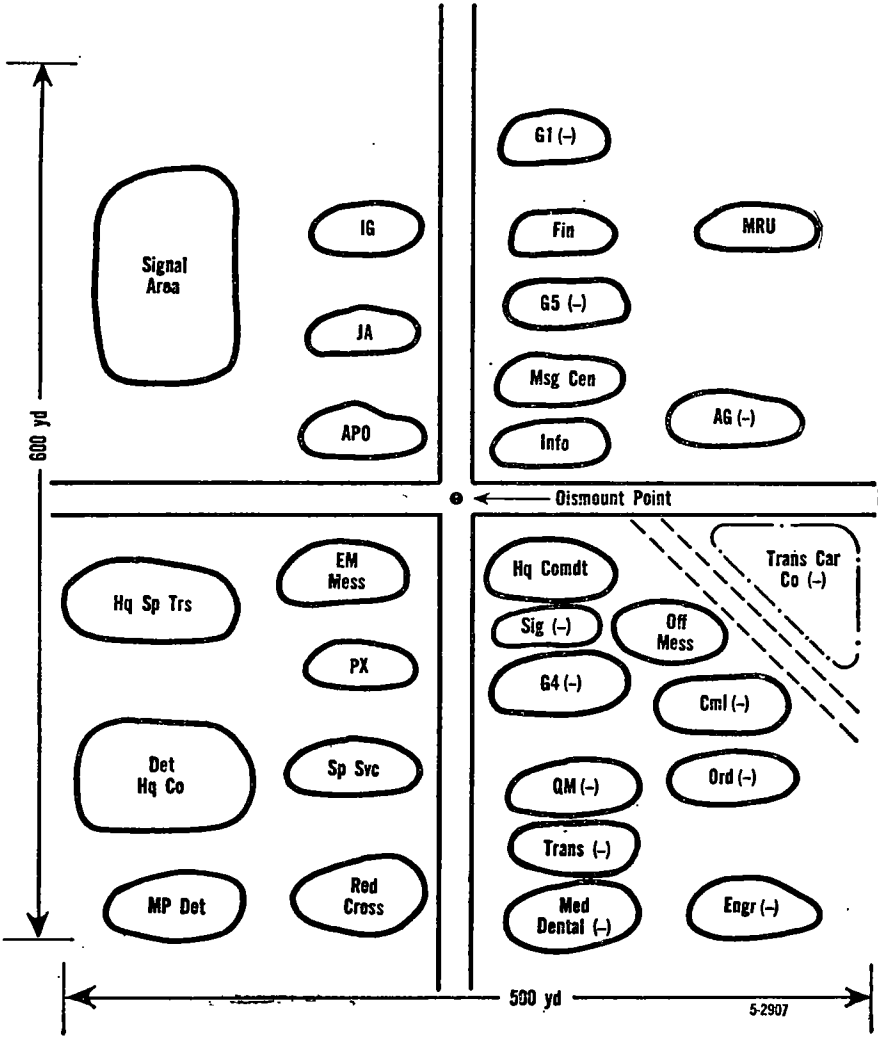
Relative Locations of Sections at Corps Rear Echelon.
Notice that the total area occupied is divided generally into three areas.
Various sections should endeavor to retain their relative positions within their respective areas.

34. Army Headquarters

a. *Forward Echelon* (not to scale).



b. Rear Echelon (not to scale).



CHAPTER 3

INTELLIGENCE

Section I. GENERAL

35. Intelligence Troop Units

Troop planning data on intelligence units are contained in paragraph 48.

Section II. MAPS

36. Responsibility for Maps and Mapping

Agency		Duties
Zone of interior	Theater of operations	
Joint Chiefs of Staff (Joint Intelligence Committee).	Theater of Operations, Unified Command (J2).	Coordinate the joint mapping and charting activities within the Department of Defense (Theater of Operations). Determine requirements and prepare plans of joint interest (necessary to support the mission assigned by the Joint Chiefs of Staff) covering the production and distribution of the various series of maps and charts required for military operations and training, and establish project priorities for the separate elements of such plans. Maintain plans and project priorities on a current basis and revise these plans and priorities in keeping with new developments. Provide guidance on operating schedules for the implementation of the operating plans. Assign responsibilities and expand or eliminate activities of the photographic, mapping, and charting agencies of the Department of Defense (Theater of Operations) when such measures are indicated and are not in conflict with existing laws and regulations. The theater of operations executes such specific mapping and charting projects as may be assigned by the Joint Chiefs of Staff. The theater of operations advises the Joint Chiefs of Staff as to map and photo requirements necessary for performance of assigned missions which cannot be met by allotted resources.
Department of the Army, Assistant Chief of Staff, Intelligence.	Theater Army Headquarters (G2).	Responsible for the mapping and charting activities of the Department of the Army (army forces in the theater of operations) and directs and coordinates these activities. Determines Department of the Army (army forces in the theater of operations) requirements and priorities for map and chart coverage pertinent to planning and operations, and takes action to meet these requirements.

36. Responsibility for Maps and Mapping—Continued

Agency		Duties
Zone of interior	Theater of operations	
Corps of Engineers.	Theater Army Engineer.	The prosecution of surveys and the execution of the photogrammetric processes involved in the production or revision of maps and photo-maps required for military purposes. Under supervision of G2, prepares plans and policies pertaining to topographic surveys and maps, including all technical aspects of mapping, together with map reproduction, supply, and distribution. Operation of the Army Map Service. Quantity reproduction of air photos for use throughout the Army (exclusive of reproduction and distribution of photos taken by organic Army aircraft). Coordination with joint, allied, and civilian mapping agencies to avoid duplication of effort and to insure the maximum uniformity of maps reproduced, as directed by G2.
Air Force.....	Theater air force.	The accomplishment of aerial photography. Aerial photography for military mapping will be accomplished in accordance with specifications and priorities prepared by the Corps of Engineers, or theater army engineer, and approved by the Assistant Chief of Staff, Intelligence, Department of the Army, or theater army G2. Aerial photography for aeronautical charting will be accomplished in accordance with specifications and priorities prepared by the Chief of Staff, US Air Force. The preparation of specifications pertaining to aeronautical charts, the procurement, compilation, reproduction, maintenance, supply, and distribution of aeronautical charts and related publications, and the establishment of geodetic control required for aeronautical charting. The development of improved technical processes and equipment used in all aerial photography and of special equipment and methods required by the US Air Force for the production of aeronautical charts. In furtherance of the above responsibilities, the Chief of Staff, Air Force, will establish facilities to provide for aeronautical charts covering the world.
G2 of divisions or larger units. Unit commander.	G2 of divisions or larger units. Unit commander.	Aerial photographic work to meet intelligence needs of combat troops. Preparation of plans and policies and supervision of all activities concerning military topographic surveys and maps, including their acquisition, reproduction, and distribution. Advance planning, which is necessary if the mapping situation is to keep ahead of the tactical situation. Good maps will seldom be on hand without special command effort.

37. Military Classification of Maps

a. General Classification.

- (1) *Topographic map.* A topographic map portrays the natural and man-made features of the earth's surface in measurable form, showing both their horizontal and their vertical positions. The vertical positions, or relief, are normally represented by contours. On maps showing relief the elevations are usually referred to a mean sea-level datum-plane.
- (2) *Planimetric map.* A planimetric map presents only the hori-

zontal position for the detail plotted. It is distinguished from a topographic map by the omission of relief in a measurable form.

- (3) *Photomap.* A photomap is a reproduction of an aerial photograph or a mosaic made from a series of aerial photographs, upon which arbitrary grid lines, marginal data, place names, route numbers, contours, important elevations, boundaries, approximate scale, and approximate direction may have been added. Photomaps are not usually contoured.
- (4) *Relief map.* A relief map depicts differences in elevation by shading, tints, etc. A molded plastic relief map is a standard topographic map printed on a plastic base and formed to produce the vertical relief, as indicated by the contour lines, at an exaggerated scale.
- (5) *Special map.* A special map is designed for a special purpose such as trafficability maps or transportation maps.

b. Classification by Scale.

- (1) *Small-scale military maps* have scales of 1:600,000 or smaller.
- (2) *Medium-scale military maps* have scales larger than 1:600,000 and smaller than 1:75,000.
- (3) *Large-scale military maps* have scales of 1:75,000 or larger.

c. Military Classification and Use.

- (1) *A general map* has a scale smaller than 1:1,000,000. It is used for general planning purposes.
- (2) *A strategic map* has a scale of 1:1,000,000. It is used for planning purposes to include movement, concentration, and supply.
- (3) *A strategic-tactical map* has a scale of 1:250,000. A map having a scale of 1:500,000 may serve as an alternate. It is used as a detailed planning map, as a graphic to illustrate briefings, as a base for medium scale plastic relief maps, as a road map, and for phases of close air-ground support. When no larger scales are available, it is used as a tactical map and to assist field artillery in fire control.
- (4) *A road map* has a scale of 1:250,000 or smaller. It is used for tactical and administrative troop movements. It gives the location of towns and roads and distinguishes between the various types of roads, road surfaces, and road capacities. Under some conditions a map at the scale of 1:250,000 will be used interchangeably as a strategic-tactical map and as a road map.
- (5) *A tactical map* has a scale of 1:50,000. It is used for tactical and administrative purposes. At times a map having a scale of 1:25,000 or 1:100,000 serves as an alternate. The tactical map is used commonly by all arms and services.

- (6) *An artillery map* has a scale of 1:25,000. It is used for directing artillery fire. A map at the scale of 1:50,000 may serve as an alternate.
- (7) *A photomap*, as defined in a(3) above, has a preferred scale of 1:25,000 and an alternate scale of 1:12,500. It is used for tactical and administrative purposes.
- (8) *A town plan* has a scale of 1:12,500 or larger. It is used to represent the road network of urban areas and to locate principal buildings and other prominent features that are of military importance and which can be plotted at this scale. A distinguishing feature of a *through-way* town plan is that it emphasizes the main thoroughfares leading through an urban area.

d. *Aeronautical Charts* are produced and distributed by the Aeronautical Chart and Information Center, Department of the Air Force. Aeronautical charts are classified according to the use for which they are intended. Principal classifications, uses, and scales follow:

- (1) *Planning charts*. Planning charts are used for the planning of world-wide air routes, controlling strategic air movements, and developing the elements of a major air-transportation system. Planning charts are published at scales of 1:5,000,000 or smaller.
- (2) *Long-range air-navigation charts*. The long-range air-navigation chart is used for celestial navigation and for dead reckoning navigation. It is published at scales of 1:1,000,000 to 1:5,000,000.
- (3) *Standard air-navigation charts*. The standard air-navigation chart is used for pilot orientation in accurate contact flying. It covers land and water areas and shows aids and hazards to navigation. The standard air-navigation chart is frequently called a pilotage chart and is published at scales of 1:250,000 to 1:1,000,000.
- (4) *Approach charts*. An approach chart may be used for the air phase of ground-air support and for contact flying in congested areas. It gives data that pertain to critical obstructions as well as other details that pertain to a desired direction of approach. It may also contain panoramic views and oblique perspectives. The approach chart is published at scales of 1:250,000 to 1:50,000 and larger.
- (5) *Target charts*. The target chart is used to designate a particular air target. This is a large-scale chart which contains schematic information that distinguishes assigned targets in a definite manner or a particular target in a general-target area.

38. Requirements for Military Maps

a. General. To calculate quantities of maps required for an operation, the following must be determined:

- (1) The number of scales at which coverage is to be provided.
Data are in *b* below.
- (2) The number of sheets of each map scale (that is the area coverage required at each scale). Data are in *c* below.
- (3) The number of copies of each sheet required for initial issue.
Data are in *d* below.
- (4) The number of copies of each sheet required for replenishment issues. Data are in *e* below.
- (5) Total copies of each scale required for each operation equals—
Sheets $\times$ copies (initial plus replenishment).
- (6) Tonnage of maps and quantities required for large units are shown in *g* below.

b. Map Scales Normally Provided in Bulk at Each Echelon.

	1	2	3	4	5	6	7
1	Unit	Theater Hq	Army Gp Hq and Army Gp Trp	Army Hq and Army Trp	Corps Hq and Corps Trp	Armd Div	Inf and Abn Divs
2	General map, small scale:						
	1:5,000,000.....	x	x	x			
3	Strategic maps, medium scale:						
	1:1,000,000.....	x	x	x			
	1:500,000.....				x		
	1:250,000.....					x	x
4	Tactical maps, large scale:						
	1:100,000.....			x	x	x	
	1:50,000.....				x	x	x
	1:25,000.....					x	x
5	Aeronautical charts.....	x	x	x	x	x	x
6	Road maps.....	x	x	x	x	x	x

*When the armored division is employed in an essentially infantry division role, it will receive this scale map.

c. Number of Sheets at Each Map Scale (i. e., the area coverage required at each scale).

- (1) *Army area coverage.* Number of different map sheets required per army on an average front of 50 miles, assuming a rate of advance of 5 miles per day and a 21-day reserve:

Scale	No. of sheets
1/5,000,000.....	1
1/1,000,000.....	4
1/500,000.....	8
1/250,000.....	8
1/100,000.....	10
1/50,000.....	22
1/25,000 (topographic and photomap).....	100

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(2) *Division and smaller unit area coverage* (i. e., number of sheets required to cover an average area of operations):

	1	2	3	4	5	6	7
1	Unit	1/1,000,000	1/500,000	1/250,000	1/100,000	1/50,000	1/25,000
2	Div Hq.....	1	5	8	10	12	20
3	Regt Hq.....	1	1	1	8	8	16
4	Bn Hq.....	0	0	1	6	6	10
5	Op Hq.....	0	0	1	4	4	6
6	Off.....	0	0	1	1	2	3
7	Veh.....	0	0	1	0	0	0
8	Wing Hq.....	10	5	12	10	12	0
9	Gp Hq.....	10	5	12	10	12	0
10	Sq Hq.....	6	2	4	0	4	0
11	Airplane.....	1	1	0	0	1	0

(3) When any series is missing, the number of individual sheets of the next major series is increased to provide equivalent area coverage; for example, in the absence of a 1/100,000 or equivalent scale series, approximately 40 sheets of the 1/50,000 series are required by division headquarters.

d. Copies of Each Sheet Required for Initial Issue.

(1) *Guides for estimating quantities.*

(a) *General.* General and strategic maps and air charts are issued in small quantities to headquarters only. The basis of issue is the unit headquarters and quantities vary in proportion to the size of the unit. Basic figures are given in table showing headquarters allowances ((g) below).

(b) *Tactical maps.*

1. *General.* Bases used in computing allowances of tactical maps vary with the type of the unit. The company is the basic unit for computing tactical map requirements. Headquarters and service companies use the same basis as other companies. Allowances for unit headquarters are given in (g) below. In addition, an allowance of 2 copies per organic army aircraft is made.

2. *Infantry and combat engineer units.* Map allowances for infantry and combat engineer units are based on the number of platoons at 2 copies per platoon.

3. *Artillery units.* Allowances for headquarters and service batteries are the same as for infantry units. Allowances for firing batteries are based on the number of sections at one per section plus two per forward observer and liaison officer.

4. *Armored units.* Tactical map allowances for armored units are computed on the same basis as infantry units plus an additional allowance based on the number of

tanks, carriages, and armored cars, with armament, at one per two vehicles.

5. *Airborne units.* Allowances for airborne units are the same as for equivalent ground troops. When engaged in airborne operations, allowances will be twice that of equivalent ground troops.
6. *Other units.* Map requirements for other units are based on officer strength at one per officer and one per reconnaissance noncommissioned officer.
- (c) *Road maps.* Road maps are issued one per vehicle.
- (d) *Air charts.* In addition to the headquarters allowances, air charts are issued on a basis of two per organic army aircraft.
- (e) *Photomaps.* Photomaps are issued as substitutes for tactical maps when the latter are not available. Where necessary as supplements to topographic maps, photomaps are issued in quantities not exceeding those authorized for topographic maps.
- (f) *Hydrographic charts.* Hydrographic charts are issued to units and headquarters as required by the situation and the mission of the unit.
- (g) *Headquarters.* In addition to the guides stated above, the quantities shown in the following table are needed by unit headquarters.

Headquarters Allowances

1	2	3	4	5	6
Unit	General	Strategic	Tactical	Road maps	Air charts
	(1/5,000,000)	(1/250,000) to (1/1,000,000)	(1/25,000) (1/50,000) (1/100,000)	(Various scales)	(Various scales)
Army Hq.....	25	75	50	75	50
Corps Hq.....	15	40	75	50	25
Div Hq.....	5	25	55	50	10
Regt Hq.....	1	7	¹ 14	15	3
Bn Hq.....	0	3	¹ 12	5	0
Co Hq.....	0	1	(²)	1	0

¹ Regiment and battalion needs for service units are 50 percent of those for combat units.

² Fifty percent of the needs for combat companies in (b) above or one copy per company whose needs are based on officer strength.

- (2) *Tables of initial allowances.* Tables of initial allowances of the several classifications of maps for infantry, armored, and airborne divisions are furnished below. These figures are computed according to the basis outlined above, and constitute quantities for initial issue. They are to be considered as a guide only. Allowances for other units can be computed in accordance with the rules in (1) above.

(a) *Infantry division.*

1	2	3	4	5	6	7
Unit	No.	General	Strategic	Tactical	Road	Aero-chart
Hq & Hq Co.....	1	5	26	79	94	26
Regt, Inf.....	3	1	36	280	350	7
Hq & Hq Co.....	(1)	(1)	(8)	(29)	(53)	(7)
Bn, Inf.....	(3)	-----	(8)	(63)	(49)	-----
Hv Tk Co.....	(1)	-----	(1)	(33)	(29)	-----
Hv Mort Co.....	(1)	-----	(1)	(9)	(40)	-----
Serv Co.....	(1)	-----	(1)	(6)	(57)	-----
Med Co.....	(1)	-----	(1)	(14)	(24)	-----
Div Arty.....	1	1	48	494	701	23
Hq & Hq Btry.....	(1)	(1)	(8)	(35)	(66)	(7)
Bn, 105-mm How.....	(3)	-----	(8)	(103)	(130)	(4)
Bn, 155-mm How.....	(1)	-----	(8)	(88)	(100)	(4)
Bn, AAA AW.....	(1)	-----	(8)	(62)	(145)	-----
Bn, M Tk.....	1	-----	7	92	168	2
Bn, Eng.....	1	-----	8	59	181	-----
Bn, Med.....	1	-----	6	30	81	-----
Bn, Ord.....	1	-----	5	21	104	-----
Co, Sig.....	1	-----	1	13	89	-----
Co, MP.....	1	1	5	96	53	-----
Co, Qm.....	1	-----	1	13	85	-----
Co, Rcn.....	1	-----	1	13	27	-----
Co, Repl.....	1	-----	1	8	5	-----
Total.....	-----	10	217	1,758	2,638	72

(b) *Armored division.*

1	2	3	4	5	6	7
Unit	No.	General	Strategic	Tactical	Road	Aero-chart
Hq & Hq Co.....	1	5	26	90	85	30
Hq & Hq Co, C Comd.....	3	1	8	25	41	3
Bn, Arm'd Inf.....	4	-----	8	77	153	-----
Bn, M Tk.....	3	-----	8	102	191	-----
Bn, Hv Tk.....	1	-----	7	92	168	-----
Div Arty.....	1	1	48	516	741	23
Hq and Hq Btry.....	(1)	(1)	(8)	(40)	(69)	(7)
Bn, 155-mm How SP.....	(1)	-----	(8)	(97)	(144)	(4)
Bn, 105-mm How SP.....	(3)	-----	(8)	(106)	(128)	(4)
Bn, AAA AW SP.....	(1)	-----	(8)	(61)	(144)	-----
Bn, Rcn.....	1	-----	8	71	156	-----
Bn, Arm'd Eng.....	1	-----	9	59	196	-----
Co, Sig Arm'd.....	1	-----	1	13	93	-----
Co, MP Arm'd.....	1	1	5	96	53	-----
Div, Tns.....	1	1	28	99	458	3
Hq & Hq Co.....	(1)	(1)	(8)	(13)	(50)	(3)
Bn, Ord M, Arm'd.....	(1)	-----	(6)	(21)	(150)	-----
Bn, Med, Arm'd.....	(1)	-----	(7)	(36)	(103)	-----
Bn, QM, Arm'd.....	(1)	-----	(6)	(21)	(150)	-----
Co, Repl.....	(1)	-----	(1)	(8)	(5)	-----
Total.....	-----	11	212	1,725	3,258	65

(c) *Airborne Division.*

1	2	3	4	5	6	7
Unit	No.	General	Strategic	Tactical*	Road	Aero-chart
Hq & Hq Co.....	1	5	26	81	100	16
Regt Inf, Abn.....	3	1	35	240	301	5
Hq & Hq Co, Abn.....	(1)	(1)	(8)	(26)	(50)	(5)
Inf Bn, Abn.....	(3)	-----	(8)	(63)	(49)	-----
Svc Co, Abn.....	(1)	-----	(1)	(6)	(47)	-----
Spt Co, Abn.....	(1)	-----	(1)	(6)	(33)	-----
Med Co, Abn.....	(1)	-----	(1)	(13)	(24)	-----
Div Arty.....	-----	1	46	463	611	23
Hq & Hq Btry, Abn.....	(1)	(1)	(8)	(29)	(61)	(7)
Bn, AAA, AW, Bn.....	(1)	-----	(6)	(37)	(60)	-----
Bn, 105-mm How Abn (ea).....	(3)	-----	(8)	(103)	(130)	(4)
Bn, 155-mm How.....	(1)	-----	(8)	(88)	(100)	(4)
Bn, M Tk.....	2	-----	7	92	168	2
Bn, Engr, Abn.....	1	-----	7	43	125	2
Bn, Med, Abn.....	1	-----	6	30	83	-----
Co, Recon, Abn.....	1	-----	1	13	27	-----
Co, Sig, Abn.....	1	-----	1	12	70	-----
Co, MP, Abn.....	1	1	5	96	41	-----
Bn, Ord, Abn.....	1	-----	5	21	104	-----
Co, QM, Abn.....	1	-----	1	13	85	-----
Co, QM, Pcht Maint.....	1	-----	1	7	18	-----
Co, Repl.....	1	-----	1	8	5	-----
Total.....	-----	10	219	1691	2508	60

*When participating in airborne operations, initial issue of tactical maps will be twice the number shown in this table.

(3) *Summary of totals for larger units* (Numbers given are number of copies of each map for initial issue and include a small reserve to be held under unit control).

1	2	3	4	5	6
Units	General 1:5,000,000	Strategic 1:250,000 to 1:1,000,000	Tactical 1:25,000 to 1:100,000	Road various scales	Aero ¹ charts various scales
Army Hq and all army non- divisional troops.....	50	600	1,500	4,500	200
Corps Hq and all corps non- divisional troops.....	40	600	1,500	3,000	100
Inf Div.....	15	250	2,000	3,000	100
Armd Div.....	15	250	2,000	3,500	100
Abn Div.....	15	250	2,000	3,000	75

¹ Production and distribution are Air Force responsibilities. Normally, Air Force distribution to troops is in bulk to zone of interior and communications zone map depots; and the engineer makes detailed distribution.

² Is 3,000 for airborne operations.

e. Replenishment Requirements. The following percentages refer to quantities an army requires under its control (in addition to the initial issue) in army map depots:

Small scale.....	100% of initial requirements.
Medium scale.....	100% of initial requirements.
Large scale.....	50% of initial requirements.

f. Number of Colors or Press Impressions.

Maximum.....	8.
Standard.....	4 (black, brown, blue, green).
Expedient.....	1, 2, 3.

Two- and three-color maps are far superior to one color and should be adopted where time for standard color reproduction is not available.

g. General Factors.

Initial issue:	Army 2,700,000 sheets	135 tons
	Corps 420,000 sheets	21 tons
Replenishment:	Army 120,000 sheets/day	6 tons/day

39. Production of Military Maps

a. Capabilities of Mapping Units.

(1) Engineer units.

	1	2	3	4	5	6
1	Units	Maps reproduced	Methods of reproduction	Sheet size (inches)	Remarks	Capabilities
2	Engineer base topographic battalion. One per army group of 3 armies, assigned to theater, located in communications zone.	Maps in large quantities. Maps of permanent utility. Special sketches and drawings. Photomaps. Production and revision of new and existing maps of all types and scales.	Lithography in 1 or more colors. Contact prints (limited numbers only). Duplicator (hectograph and similar means).	22 x 29--	Battalion is prepared to take over and operate presses of large sizes. Generally assigned long range mapping projects.	New mapping—50 sq mi per day, beginning 21 days after receipt of aerial negatives required. Photomaps—100 sq mi per day beginning 10 days after receipt of aerial negatives. Simultaneous with topographic mapping reduces the latter by 20 sq mi per day. Reproduction—4,000,000 impressions per month on runs of 20,000 copies. Surveying—Six field parties for triangulation, traverse, or level line instrumental survey. Five sq mi per day of plane table survey at a scale of 1/10,000 or smaller.
3	Engineer topographic battalion, army. One per army.	Revision and reproduction of existing maps. Provisional maps and photomaps of unmapped areas for tactical and fire-control use. Sketches and drawing.	Lithography in 1 or more colors. Contact prints (limited numbers). Duplicator (hectograph and similar means).	22 x 29--	Battalion organized for quantity reproduction to meet the more local reproduction needs of the Army.	New mapping—10 sq mi per day beginning 15 days after receipt of photographs. Photomaps—40 sq mi per day beginning 15 days after receipt of photographs. Reproduction—1,200,000 impressions per month on topographic maps in colors. Surveying—One field survey platoon with four field survey parties capable of triangulation, traverse, level line, and plane table survey.
4	Engineer topographic Company corps. One per corps.	Revision and reproduction of existing maps. Provisional and photomaps. Mosaics. Maps of limited areas. Overlays, and sketches.	Lithography in 1 or more colors. Contact prints (very limited numbers only). Duplicator (hectograph and similar means).	22 x 29--	Multicolor reproduction possible in cases where exactness in matching color plates is not essential and time is available.	New mapping—5 sq mi per day beginning 10 days after receipt of photographs. Photomaps—30 sq mi per day beginning 3 days after receipt of photographs. Reproduction—600,000 impressions per month on topographic maps in colors. Surveying—Two field survey parties capable of instrumental surveys.

	1	2	3	4	5	6
1	Units	Maps reproduced	Methods of reproduction	Sheet size (Inches)	Remarks	Capabilities
5	Engineer aerial photo reproduction company.	Prints of aerial reconnaissance photographs.	Contact printing aerial photos from negatives.	Varies...	Company reproduces, identifies, and prepares for distribution prints of aerial reconnaissance photos. Unit assigned to Joint Aerial Photo Center	Reproduction, identification and packaging 25,000 diazo-type prints of aerial photos per operational period of 10 hours.
6	Engineer aviation topographic organization.	Same as engineer topographic company, corps, or engineer base topographic battalion. Revision of existing aeronautical charts. Preparation of target charts.	Same as engineer topographic company, corps, or engineer topographic battalion.	22 x 29..	May be organized as Engr Avn Topo Co or Engr Avn Topo Bn to fit the need of the air force to which assigned. Equipment and organization is same as for Engr Topo Co. Corps, or Engr Topo Bn Army.	Same as for corps topographic company.
7	Division engineers..	Simple sketches, overprints, and overlays.	Duplicator (holograph and similar means).	22 x 33..	Lithographic reproduction not possible.	

(2) *Air Force photographic units.*

	1	2	3
	Unit	Photographs furnished	Remarks
1	Reconnaissance wing (T of ops).	Specialized photography needed by topographic units for photogrammetry (multiple-lens or wide-angle single-lens type). Vertical and oblique photographs and mosaics for strategic purposes beyond the scope of reconnaissance wings of tactical air commands and tactical air forces.	Wing may include mapping and charting squadrons. Mapping photography ordinarily not suitable for intelligence purposes because of small scale and lack of detail. May contain important information, however, and prints should be made available to military intelligence officers for study.
2	Reconnaissance wings of tactical air commands and tactical air forces (ftr.)	Photographs needed for intelligence or combat purposes (single photographs, vertical and oblique, stereopairs, or night photographs).	Reconnaissance missions capable of visual observation and limited vertical and oblique photographs. Photographic missions capable of large quantities of high-altitude, vertical, and oblique photographs and, under extremely urgent circumstances, limited and low-altitude vertical and oblique photographs.

b. Production Data by Map Type ^{1 2 3}

	1	2	3	4	5	6	7	8	9	10
	Kind of map	Scale	Contour interval (ft.)	Sheet size (in.)	Size of area	Purpose	Natural features and works of man shown	Originals and limited number of copies prepared by—	Reproduced in quantity by—	Probable time or conditions when available ⁴
1	Vertical aerial photograph.	1:5,000 to 1:60,000 (12 inches=1 mile to 1 inch=1 mile).	-----	Varies.....	Varies depending on scale.	Intelligence. Map supplement for study of terrain and other detail. Mosaics, preparation of stereopairs and tripiets.	Varies.....	Air Force, civilian agencies.	Lithographic copies by base and army topographic battalions, and corps topographic companies. Contact prints by air photo reproduction companies.	Limited numbers: 3 to 5 hours after photography. Quantities: 48 hours after photography. ⁴
2	Oblique aerial photograph.	Varies.....	-----	Varies.....	Varies, depending on scale.	Intelligence. Map supplement for study of terrain and other detail.	Varies.....	(As above)-----	(As above)-----	(As above).
3	Tri-metric photograph.	Vertical: As taken. Oblique: Varies.	-----	Max. of 22 by 29.	Varies depending on scale.	Map supplement, aeronautical chart production.	Varies.....	(As above)-----	(As above)-----	(As above).

¹ The information contained in this table is in accordance with present military standards. Appropriate modifications are necessary for emergency war time reproduction of foreign maps and of United States maps made by civilian agencies.

² Maps of foreign theaters available for initial operations, will vary from direct one color reproduction of foreign maps without translation of names and symbols, to multi-color maps compiled in accordance with United States standards. Any of the maps

listed herein may be issued in a hasty and less accurate form, in which case they are called provisional maps.

³ In the United States, topographic maps also are published by civilian agencies at a variety of scales including: 1:24,000, 1:31,680, 1:62,500, 1:63,360, and 1:125,000. Various additional scales also may be encountered in foreign maps.

For additional footnotes see end of table.

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	1	2	3	4	5	6	7	8	9	10
1	Kind of map	Scale	Contour interval (ft.)	Sheet size (in.)	Size of area	Purpose	Natural features and works of man shown	Originals and limited number of copies prepared by—	Reproduced in quantity by—	Probable time or conditions when available ⁴
	Photo-map.....	Approximately 1:5,000, 1:10,000, 1:25,000, 1:50,000.	-----	Max. of 22 by 20.	Varies, depending on scale.	General field uses as map supplement. Limited horizontal control for unobserved artillery fire.	Varies.....	Base and army topographic battalions. Corps topographic companies. Civilian agencies.	Base and army topographic battalions. Corps topographic companies (lithographic copies).	75 to 185 man-hours. 24 to 72 hours after photography, depending on amount of control used. Time includes mosaic and reproduction.
6	Mosaic.....	As taken, enlarged, or reduced.	-----	Maximum of 19 by 20 to 22 by 29 depending on organization printing.	Varies, depending on scale.	General field uses as map supplement. Approximate horizontal control or limited unobserved artillery fire.	Varies.....	Army topographic battalions. Corps topographic companies. Civilian agencies. Air Force units up to ten prints, when directed by proper authority.	Army topographic battalions. Corps topographic companies (lithographic copies).	75 to 100 man-hours. 24 to 48 hours after photography. Time includes mosaics and reproduction.
7	Strip mosaic.....	As taken, enlarged, or reduced.	-----	Depends on number of photographs.	Varies, depending on scale.	General field uses as map supplement. Approximate horizontal control for limited unobserved artillery fire.	Varies.....	Air Force. Corps topographic companies. Civilian agencies.	Corps topographic companies (lithographic copies).	50 to 75 man-hours or 24 hours after photography. Time includes mosaics and reproduction.

	Strategic map...	1:1,000,000....	Metric contours at 100, 200, 500, 1,000, 1,500, 2,500, 3,000, 3,500, 4,000 and even thousands thereafter.	26 x 32.....	Standard 4° NS by 6° EW.	Strategy and logistics.	Drainage, relief with gradient tints, populated places, communications.	Army Map Service.	Army Map Service and base reproduction plants.	700 to 2,000 man-hours. Time includes compilation, drafting, reproduction. Reproductions 24 hours.
9	Topographic map, contoured, medium scales. ⁸	1:250,000.....	Foreign: 20 or 100 meters. US: 100 or 500 ft. augmented with hill shading.	Max. 24 x 28.	Standard 1° NS by 2° EW.	Strategy and logistics. Mechanized and motorized units.	Stream lines, vegetation, and ground forms. Railroads, roads, towns, air fields, etc.	Army Map Service.	Army Map Service and base reproduction plants.	700 to 4,000 man-hours. Time includes compilation, drafting, reproduction. Reproductions 24 hours.
10	Topographic map, contoured. ⁸	1:100,000.....	US: 20 or 100 ft. Foreign: 10, 20, or 40 meters.	Max. 22 x 29.	US: 30' x 30'. Foreign: 20' NS x 30', 40', or 60' EW depending upon latitude.	Substitute for 1:50,000 topographic map.	Stream lines, vegetation, and ground forms. Railroads, roads, towns, air fields, etc.	Army Map Service. All military cartographic units.	All military reproduction units.	450 to 5,000 man-hours depending on compilation method. Time includes compilation, drafting, and reproduction. Reproductions 24 to 48 hours.
11	Topographic map, contoured. ¹	1:50,000.....	US: 5 to 50 ft. Foreign: 10 or 20 meters.	Max. 22 x 29.	US: 15' x 15'. Foreign: 10' NS x 15', 20', or 30' EW depending upon latitude. (Certain exceptions.)	General field uses. Tactical and logistical studies by units from corps to regiment.	Drainage systems, water, relief, and forested areas. Railroads, roads, bridges, dams, towns, buildings, etc.	All military cartographic units.	All military reproduction units.	500 to 9,000 man-hours depending upon compilation method. Time includes compilation, drafting and reproduction. Reproductions 24 to 48 hours.

For additional footnotes see end of table.

	1	2	3	4	5	6	7	8	9	10
1	Kind of map	Scale	Contour interval (ft.)	Sheet size (in.)	Size of area	Purpose	Natural features and works of man shown	Originals and limited number of copies prepared by—	Reproduced in quantity by—	Probable time or conditions when available *
12	Topographic map, contoured. ¹	1:25,000.....	US: 5 to 50 ft. Foreign: 10 or 20 meters.	Max. 22 x 20.	US and Canada: 7½ x 7½'. Foreign: 8' NS x 7½', 10' or 15' EW depending upon latitude. (Certain exceptions.)	General field use. Tactical and logistical studies by units from corps to regiment.	Drainage systems, water, relief, forested areas. Railroads, roads, bridges, dams, populated places, buildings, coastal hydrography, etc.	All military cartographic units.	All military reproduction units.	600—4,500 man-hours depending upon compilation method. Time includes compilation, drafting and reproduction. Reproductions 24 to 48 hours.
13	Coast charts and harbor charts.	Miscellaneous.	-----	Varies.....	Varies, depending on scale.	Coast artillery in harbor defense. All arms in coastal frontier defense.	Hydrography, stream lines, coast line. Harbor, docks, aids to navigation, railroads, roads, towns, air fields, etc.	Coast and Geodetic Survey. U. S. Hydrographic Office. U. S. Lake Survey Office.	Coast and Geodetic Survey. Base reproduction plants. Base and army topographic battalions.	Reproductions: 24 to 48 hours.
14	Transportation maps.	Miscellaneous frequently 1:1,000,000.	Contours seldom shown.	Varies.....	Varies.....	Logistics, maintenance, and operation of communications.	Roads and railroads, drainage systems, water, etc.	Base plants, civilian agencies, Public Roads Administration.	Civilian agencies. Base reproduction plants. Base and army topographic battalions. Corps topo-	Reproductions: 24 hours more.

15	Road maps (civil).	Miscellaneous.	-----	Varies.....	Varies.....	Logistics. Concentration of mechanized units. Maintenance and operation of communications.	Drainage systems, water etc.	Civilian agencies.	graphic companies. Automobile associations, oil companies, etc.	4 to 12 hours elapsed time, depending upon number of colors. Time for reproduction only.
16	Aeronautical charts pilotage.	1:1,000,000 and 1:250,000.	Elevations shown by color or gradients.	Varies.....	Varies.....	Aerial navigation and as strategical map substitute.	Stream lines and ground forms. Railroads, roads, towns, air fields, and aids to aerial navigation.	Coast and Geodetic Survey. U. S. Hydrographic Office. Corps of Engineers.	Coast and Geodetic Survey. U. S. Hydrographic Office. Base reproduction plants.	Reproductions: 24 to 48 hours.
17	Aeronautical charts, approach.	1:250,000 to 1:50,000 or larger.	-----	14 by 17 or larger.	Varies.....	Used by air in approaching objectives.	Prominent features, roads, etc.	Air Force -----	Air Force.....	24 hours and up.
18	Aeronautical charts, target.	1:75,000 (varies).	-----	14 by 17 or larger.	Varies.....	Contains information necessary to distinguish assigned air targets.	Prominent features, roads, etc.	Air Force.....	Air Force.....	24 hours and up.

* Size of run and number of colors will govern reproduction time. Estimated time is given in man-hours for 1,000-sheet runs unless otherwise indicated. Generally, actual number of days for peacetime mapping can be determined by dividing man-hours by 40 (average 5 men working simultaneously on an 8-hour day); elapsed time during wartime will be reduced depending upon number of men working simultaneously and number of hours worked by each per day. Time estimates are predicted upon adequately organized, equipped, and trained mapping (Air Force and Engineer)

and reproduction (Engineer) troops. Under less favorable conditions more delay must be expected.

* Under most favorable conditions, a single wet-print can be dropped within 30 minutes after photography, when the rapid type of photography is used, in which case no negative is available.

* Overprinted with 10,000 meter Universal Transverse Mercator Grid.

* Overprinted with 1,000 meter Universal Transverse Mercator Grid.

c. General Production Factors.

- (1) In planning an operation, map requirements are estimated well in advance of the operation and are requisitioned from the zone of interior. Theater, army, and corps produce maps to supplement planned requirements. As a general rule, supplemental maps of a scale of 1/100,000 and larger are reproduced by army and corps; maps of 1/250,000 and smaller scale, by the communications zone.
- (2) Press size—22½ in. x 30 in.
- (3) Impressions per press-day—30,000 (bulk work only).
- (4) Average map paper consumption per
army----- 5,000 reams/month.
167 reams/day.
- (5) Maximum map paper consumption per
army----- 500 reams/day.
- (6) Photomap paper consumption per army - 1,000 reams/month.

d. Production Capacity Required.

- (1) Army—3,000,000 impressions per month.
- (2) *Communications zone.*
 - (a) Five million impressions per month for each three armies supported.
 - (b) *A new mapping capacity of 100 square miles per day.*

40. Storage of Maps

a. Weights and Cubages.

(1) *Paper.*

Sheet size (in.)	Line map—High wet strength* (lbs. per 1,000 sheets)	Photomap—Coated two sides (lbs. per 1,000 sheets)
20 x 22½.....	55.6.....	66.4
22 x 29.....	81.9.....	94.1
24 x 34.....	104.7.....	120.4
26 x 32.....	106.8.....	122.7
28 x 50.....	179.6.....	206.6
Sheet thickness.....	.0040-in.....	.0035-in.
Thickness, 1,000 sheets.....	4-in.....	3.5-in.

*For United States hydrographic charts, use twice weights shown for high wet strength paper.

(2) *Crated or bundled maps.*

Packaging	Weight*	Cubage
Bundle, 500 map sheets.....	60 lb.....	2 cu ft.
Crate, 1,000 map sheets.....	150 lb.....	5 cu ft.

*Average figure for planning purposes.

b. Floor Space.

- (1) Base map depot for each group of three armies—45,000 square feet, increasing at the rate of 7,500 square feet per month of operations.
- (2) Base map depot for each air force—10,000 square feet, increasing at the rate of 2,000 square feet per month of operations.
- (3) Advance map depots serving each army—10,000 square feet.

41. Map Distribution

a. General. Although maps are an item of Class IV supply, there are several features which establish them as a peculiar supply item which must be handled separately through a system set up exclusively for this purpose. The special features which place map distribution in a class by itself are—

- (1) *Security.* Bulk production, movement and issue of maps are accurate indexes of the scope of forthcoming operations.
- (2) *Transitory application.* Changes in culture as revealed by the constantly expanding sources of information may quickly render maps obsolete and may require several improved editions or issues in the course of a single operation.
- (3) *Relation to the operation.* Unlike other supply items, maps have a direct relation to the exact place in which the operation is to occur.
- (4) *Phasing of supply.* In general, bulk stocks of maps cannot be prepared, and distribution planned, far in advance. However, collection of source material for map production must be constant and world-wide. Production must be phased to insure the application of the last bit of terrain information which can be safely used. Issue can be made only after an exact assignment of missions has been made.

b. Responsibility.

- (1) Map requirements for a command are computed by the engineer under the staff supervision of the G2. Requisitions are prepared and submitted through engineer channels in sufficient time to permit the reproduction and shipment of the maps required.
- (2) Engineers of divisions and larger units are charged with the distribution of military maps in the field, except such confidential or secret maps as may require special distribution. They obtain maps not printed by their echelons from the engineers of the next higher units.

c. Depots.

- (1) *Peacetime and zone of interior.* Distribution is made by

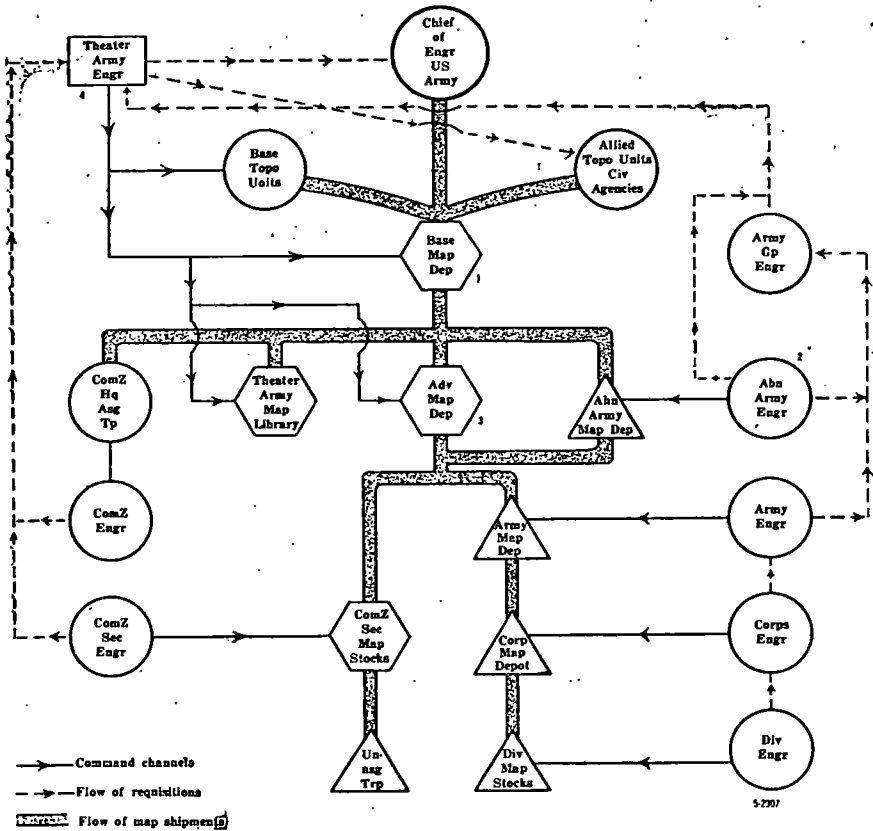
requisitions drawn on the Army Map Service through channels as prescribed by the Chief of Engineers.

(2) *Wartime theater of operations.*

- (a) Base and advance depots are located in the communications zone, with the advance depot near the forward limit of the communications zone. Base map depots receive and store bulk stocks from the Army Map Service and base reproduction plants; break down and distribute bulk stocks to advance depots; distribute to base depot units; and operate a retail map store for base headquarters. Advance map depots receive and store bulk stocks from base map depots; break down and distribute bulk stocks to army map depots; and operate a retail map store for the headquarters of units located in the area.
- (b) The army map depot is located in the army service area, usually near army rear headquarters. In a fast moving operation it may be necessary to operate two map depots which leapfrog over each other as the army headquarters moves forward. The army map depot has functions parallel to those of the base map depot. The depot is operated by the map storage and distribution section of the army topographic battalion.
- (c) The corps map depot is located in the corps service area and has the same functions as the base map depot, but on a smaller scale. It is operated by a section of the corps topographic company.
- (d) Operation of the division map stores is the responsibility of the division engineer. The only functions performed are to receive bulk stocks, distribute maps to divisional and attached units, and store the division reserve map stocks.

d. Labor Estimates. Map depot labor may be estimated at 20 man-hours per 10,000 maps issued, including rolling, coding, packing, and collating unit packages.

e. Flow Chart.



Notes

¹ 45-day reserve supply.

² Channels of requisitions and map shipments for airborne units depend upon location and assignment of these units in the theater of operations.

³ 10-day supply.

⁴ Air Force map depots are supplied with maps, other than aeronautical charts, in the same manner as army depots. Air Force engineers submit requisitions to theater Army engineer.

42. Determining Map Requirements

a. *Preliminary Planning.* Army G2 confers with G3 to determine the types and scales of maps to be used by subordinate units and army headquarters. An operational map is selected for use by army and corps headquarters so that all orders, overlays, and references will be based on the same map. The army engineer attends these staff conferences to advise on the availability of maps in army and base map

depots, capacity of reproduction facilities, and types and scales which can be most readily reproduced. G3 outlines the area for which map coverage is desired. This area will be well in advance of the present front lines of the army because of the time required for procurement, production, reproduction, and distribution of maps. In addition, maps of the future area of operations are required early for planning purposes. G3 also outlines tentative future dispositions, direction of attack, and boundaries of army and subordinate units. This tentative information will be used by the engineer in determining map requirements for the army.

b. Method. With the information furnished by G2, G3, and the data in paragraphs 35–40, or similar data developed through experience, the army engineer calculates map requirements for all units of the army and army headquarters. The procedure is as follows:

- (1) Lay out the projected army area for which coverage is desired on the pertinent index map.
- (2) In the army area outlined on the index map, lay out the tentative corps and division boundaries. Project these boundaries to cover the entire area for which map coverage is desired. While these projected boundaries will change during the campaign, divisions and corps of the army will operate in the area. Therefore, calculations based on one pattern of operations are valid for map procurement purposes.
- (3) List the units requiring each map sheet. Note that divisions in reserve will require map sheets of the entire front in which they may be employed.
- (4) List the identifying numbers of the map sheets required to cover the area included within the army boundaries, including sheets bordering closely on the boundaries.
- (5) Determine the number of copies of each sheet required at each echelon, using factors in paragraph 38*d*(3), or developed experience factors.
- (6) List the total number of copies of each map sheet required. These are planning figures for *initial issue*. *Replenishment requirements* are determined by multiplying the numbers of each sheet required for initial issue by the proper percentage factor in paragraph 38*e*. The sum of the initial requirement plus the replenishment requirement for each sheet represents

the total number of copies of each sheet that must be procured. These are procured from higher echelon or produced by topographic units within the army.

43. Terrain Models

a. Classification.

Type of model	Horizontal scale	Vertical exaggeration
Strategic planning.....	1:250,000 and smaller.....	4:1 up to 10:1
Tactical planning.....	1:100,000 to 1:25,000.....	2:1 up to 4:1
Assault landing.....	1:25,000 to 1:5,000.....	1:1 up to 2:1
Airborne landing.....	1:5,000 to 1:500.....	1:1 up to 2:1
Assault.....	1:10,000 and larger.....	1:1 up to 2:1
Aerial target.....	1:5,000 to 1:2,500.....	1:1 up to 2:1

b. Quantity Requirements. The determination of quantity requirements and the issuance of terrain models is a matter for staff control. Terrain models and plastic relief maps are seldom stocked outside base plants. The Army Map Service is currently the only base plant for terrain models and does stock plastic relief maps at scales of 1:250,000, 1:1,000,000, and certain other miscellaneous scales. These maps can be requisitioned through proper engineer channels. Quantity requirements depend solely upon the estimate of the military situation. The necessary provisions to meet those requirements are determined by staff studies of combat needs; the resultant production and supply of models are determined by command decision. The commander, having model-making units under his control, directs that a G2 intelligence study and an engineer technical appraisal be performed to determine what models are to be constructed. When assigned model-making capacities are inadequate, the commander submits appropriate requests to higher headquarters. Upon completion of construction, the model is issued immediately and directly to the headquarters or command for which it was produced.

c. Production Rates.

1	2	3	4		5	6	7	8
Unit	Type of model	Per- cent of pro- duc- tion capa- city	Man-hours		Num- ber of quads per month	Output of original in sq ft per 8- hr day	Output of copies in sq ft per 8-hr day	Man- hours per square foot of original
			Class	Per day				
	RUBBER CASTINGS							
Theater HQ, 3 pla- toons, 6 officers, 120 enlisted men.	Assault (band painting re- quired).	100	{ Const.....	472	9	5.2	57.5	165
			{ Control....	104				
			{ Repro.....	40				
			{ Finish.....	288				
	Total.....	100	-----	904	9	5.2	57.5	165
VINYL-PLASTIC EMBOSSED MODELS								
CONUS HQ, 12 offi- cers, 238 enlisted men.	{ Assault.....	25	339	2 24	4.2	112	80	
	{ Tactical.....	45	610	2 24	4.3	112	140	
	{ Strategic.....	30	408	2 17	2.9	74	140	
	Total.....	100	1,357	65	11.4	298		
Theater HQ, 6 officers, 120 enlisted men.	{ Assault.....	50	260	2 18	3.3	112	80	
	{ Tactical.....	40	208	2 8	1.5	74	140	
	{ Strategic.....	10	52	2 2	.4	37	140	
	Total.....	100	520	28	5.2	223		
TOE 5-500 Relief Map-Making Team, 1 officer, 18 enlisted.	{ Assault.....	50	52	2 3	0.65	37	80	
	{ Strategic.....	50	52	2 2	.37	37	140	
	Total.....	100	104	5	1.02	74		

1 3 by 5 ft.

2 22 by 29 in.

Section III. TIME, TIDE, AND LIGHT**44. Designating Time and Date**

a. Time. Time is expressed in a group of four digits ranging from 0000 to 2400. The first two digits are the hours after midnight, and the remaining two digits indicate the minutes past the hour. Where the hour can be expressed by a single digit, it is preceded by zero (0), for example 0625 for 6:25 a. m.

b. Date.

- (1) The day, month, and year are expressed in that order, except when it is necessary to specify a 6-digit time group and then

the following order is used: the first two digits indicate the day of the month, the next two digits indicate the hour, and the last two digits indicate minutes past the hour.

Example: 070625 Dec 47 (6:25 a. m. 7 Dec 47).

The day is expressed by numerals; the month is either spelled out or abbreviated. Abbreviations, if used, consist of the first three letters of the word. The year is expressed by four digits or by the last two digits.

Example: 14 January 1946; 14 Jan 1946; 14 Jan 46.

- (2) When it is desired to keep the date secret, dates may be expressed by a letter such as D plus or minus a numeral.

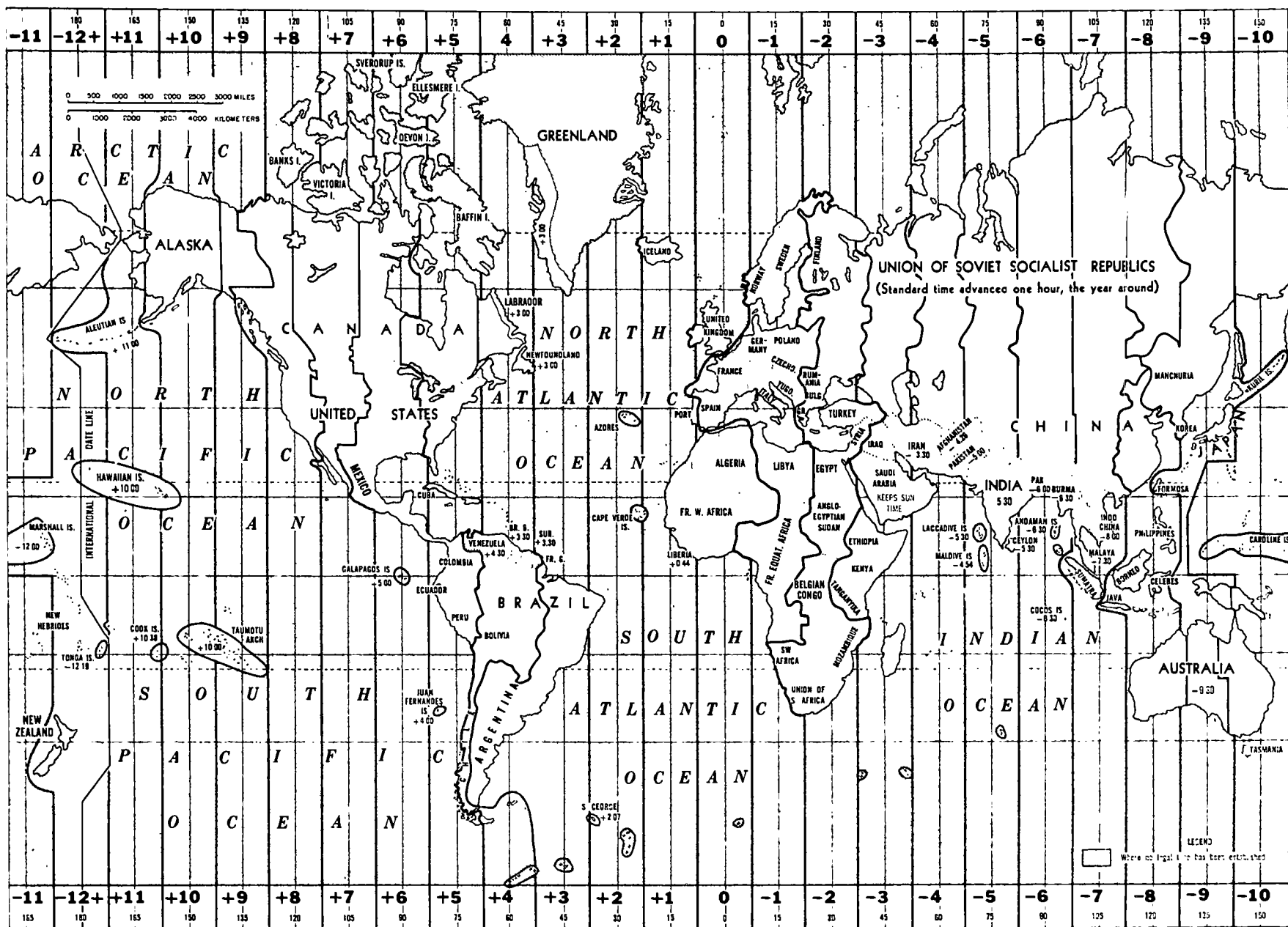
c. Greenwich Civil Time. Communications between headquarters in different time zones are usually dated, and references to dates and times are usually made, in Greenwich civil time. The standard time at Greenwich, England, is accepted as the basis for measuring time throughout the world. Local civil time can be changed to Greenwich civil time by adding or subtracting the appropriate number of hours as indicated in the time zone chart, *e* below. Greenwich civil time can be changed to local civil time by reversing the signs of the time zone chart. Appropriate adjustment must be made for daylight saving time and war time.

d. Time Suffixes. Time groups expressing Greenwich civil time are designated by the letter suffix Z immediately following the last digit of the group. For example, 190225Z indicates 2:25 a. m. on the nineteenth of the current month, Greenwich civil time. Any other suffix used after a four digit time group (corresponding to the Z of Greenwich civil time) indicates the zone in which the local civil time is expressed. *It does not designate location on the earth's surface.* The proper suffix can be determined from the time zone chart and the time conversion table in *e* and *f* below. For example, Kansas City is located in the sixth time zone west of Greenwich. If that city keeps local civil time, the time group suffix will be S.

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TIME ZONE	HOURS OF DAY IN LOCAL CIVIL TIME																																																																							
	PREVIOUS DAY																								SAME DAY																								NEXT DAY																							
0 (Z)	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11																								
-1 (A)	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12																								
-2 (B)	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13																								
-3 (C)	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14																								
-4 (D)	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15																								
-5 (E)	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15																									
-6 (F)	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17																								
-7 (G)	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17																									
-8 (H)	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19																								
-9 (I)	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21																							
-10 (K)	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22																							
-11 (L)	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22																								
-12 (M)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23																								
+1 (N)	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11																							
+2 (O)	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10																							
+3 (P)	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08																								
+4 (Q)	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07																								
+5 (R)	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06																								
+6 (S)	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05																								
+7 (T)	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04																								
+8 (U)	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03																								
+9 (V)	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01																									
+10 (W)	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00																									
+11 (X)	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00																								
+12 (Y)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23																								
	PREVIOUS DAY																								SAME DAY																																															

e. Time Zone Chart.



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45. Expression of Natural Phenomena

a. Staff officers avoid the use of such indefinite terms as *first light*, *last light*, *daybreak*, *daylight*, *darkness*, *dusk*, and *dawn*. Terms of a definite nature, as *sunrise*, *sunset*, and *beginning* or *ending of evening* or *morning nautical* or *civil twilights* are permissible. However, expressions of these times to lower units must be in clock time.

b. For purposes of military planning and to facilitate staff work in expressing natural phenomena in time, theater commanders prepare and publish for the theater as a whole or for major geographic portions thereof, daily time, sunrise, sunset, twilight, moon, and tide tables, and specify the number of hours the local time differs from Greenwich civil time.

46. Tides, Sunlight, and Moonlight

a. *General.* A sample of the type of chart which should be prepared and issued for each major operation or operational area is shown in *j* below. These charts are prepared by the Joint Intelligence Study Publishing Board and appear in "JANIS." They are available through Army channels for many portions of the world.

b. *Area Covered.* The astronomical data are for sea level and will not vary more than 5 minutes for each degree of the difference in longitude from the standard meridian.

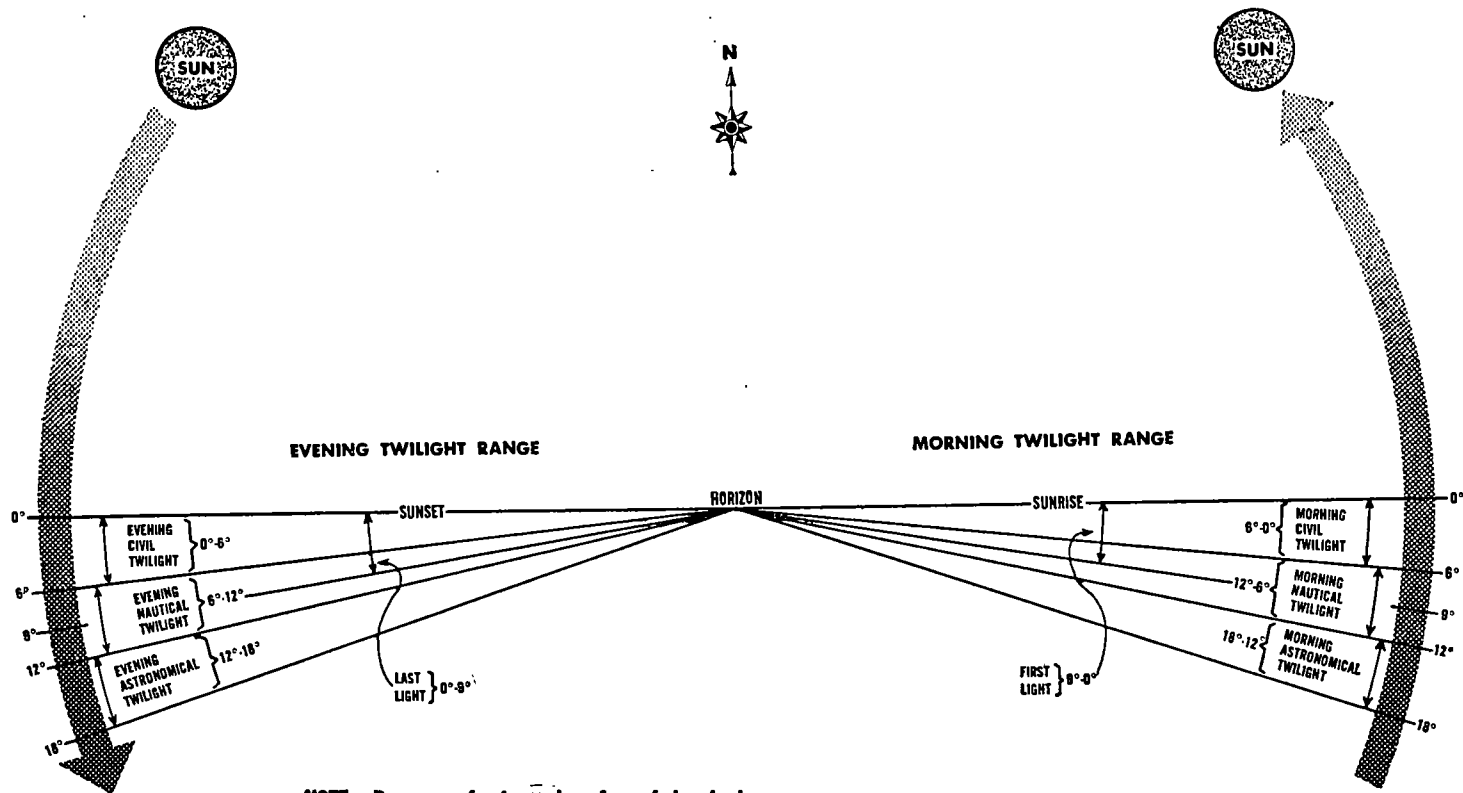
c. *Time Used.* The times on the diagram are for the time meridian indicated in the heading. When another time meridian is to be used in the field, it will be found convenient to change the figures representing hours on the left of the large diagram to conform to the new time. If the time meridian to be used is east of the one shown on the diagram, increase the figure by 1 hour for each 15°; if west, decrease the figures.

d. *Dates.* In the upper diagram, each day from midnight to midnight is represented by a space between 2 lines. In the lower diagram the days are represented by vertical lines covering the period from noon of one day to noon of the next. The dates at the bottom of the diagram differ from those at the top because the date changes in passing through midnight.

e. *Tides.* The times of the high and low tides are shown by curves in the lower diagram. By noting the sequence of the tides during a day, the height of any particular tide can be found from the upper diagram.

f. *Twilights, Morning and Evening.*

- (1) Twilights are the periods of solar illumination prior to sunrise and after sunset. Both morning and evening twilights are divided into three periods: astronomical, nautical, and civil. The interval of time between when the upper edge of



NOTE.—Degrees refer to center of sun below horizon.

Twilight factors.

the sun's disk appears to be exactly on the horizon and the instant the center of the sun is 6° below the horizon is civil twilight, 6° – 12° nautical twilight, and 12° – 18° astronomical twilight.

- (a) Astronomical twilight affords such meager light, if any, that for military purposes it may be considered as a period of darkness.
- (b) Nautical twilight provides enough illumination to carry on most types of ground movement without difficulty, and approaches conditions expected under full light of day. Vision is limited to 400 yards or less. For military purposes, during the nautical periods weapons can be employed within the range of vision stated and daylight calculations relative to movement will apply, including restrictions on such movement. Bomb loading and repair work cannot be carried on without the use of artificial light.
- (c) Civil twilight affords sufficient light to carry on normal day activities. This period is the earliest or latest that provides sufficient natural illumination of targets to allow efficient observed artillery fire or day bombing.
- (d) The above disregards weather and local surroundings (i below).
- (2) Except for high latitudes, values for the approximate durations of astronomical, nautical, and civil twilights may be considered equal.
- (3) First light and last light, terms used by the armed forces of the United Kingdom, include a slightly greater period of twilight than defined by civil twilight.

g. Moonlight. For astronomical twilight and solar darkness, periods of moonlight and dim moonlight are shown on the lower diagram. During the period of *moonlight*, the intensity of light will vary between the brightness of the full moon at zenith and about one-third of this value. During the period of *dim moonlight*, the intensity varies from about one-third to one-tenth of the brightness of full moon at zenith.

h. Moon's Phases. The phases of the moon are shown below the day on which they occur.

i. Effect of Weather on Light. Weather has been disregarded in these calculations. Smudge, fog, clouds, refraction, reflection, and precipitation affect the degree of illumination. These factors can be included in the calculations by means of experience tables compiled in the area over a period of time and from meteorological forecasts for the area only.

j. Diagram of Tides, Sunlight, and Moonlight.

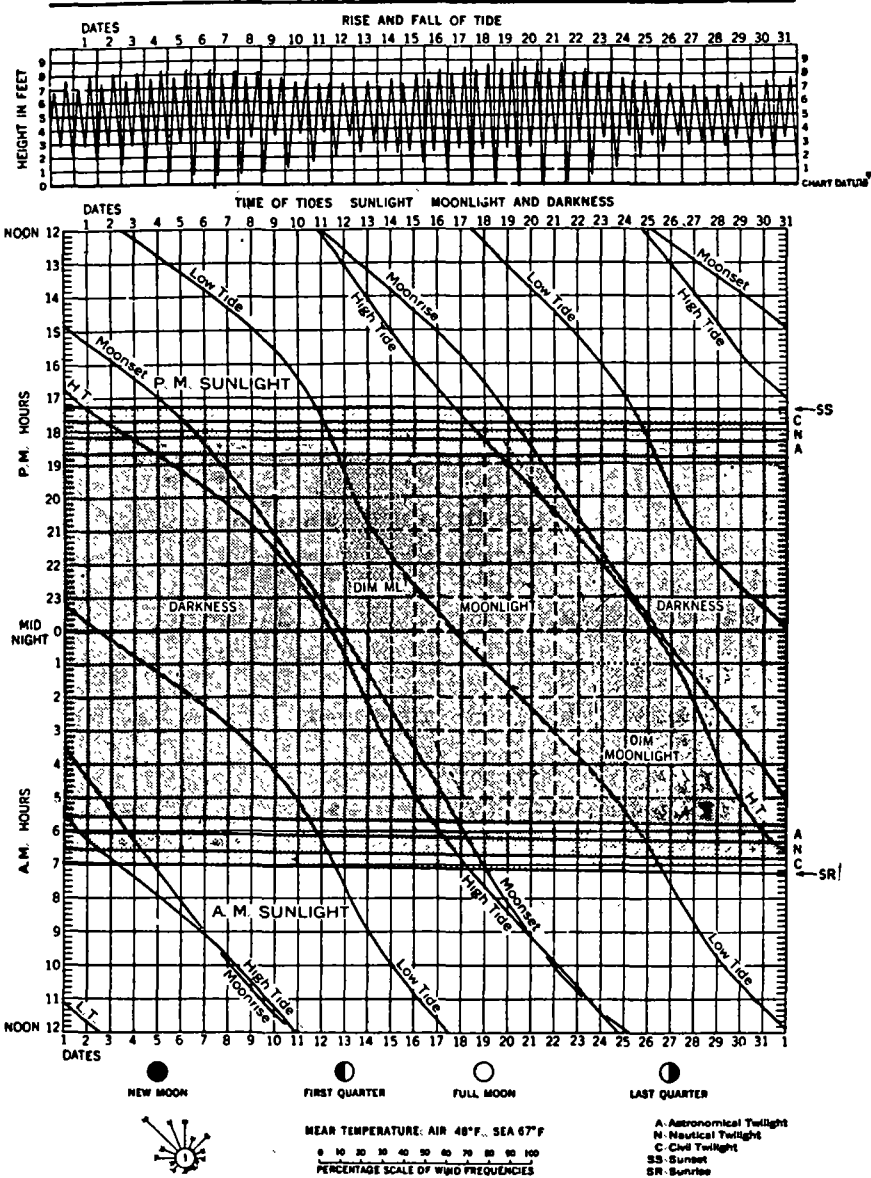
KAGOSHIMA—WAN, KYUSHU *

DECEMBER 1945

Lat 31°30' N., Long 130°40' E.

Time Meridian: 135° E.

Sunlight and Moonlight Data Computed for Lat 31°30' N., Long 130°40' E.



*This diagram, with the changes indicated, is also applicable to the following places:
 TOMARI URA - Add 10 minutes to times of high and low tides, subtract 1 foot from heights of high tides.
 ODOMARI-WAN - Subtract 25 minutes from times of high and low tides, subtract 1 foot from heights of high tides.

Prepared by the U. S. Coast and Geodetic Survey
 at the request of the U. S. Hydrographic Office

CHAPTER 4

OPERATIONS

Section I. TROOP PLANNING

47. General

a. The number and type of units to be employed in a given operation is determined by: the mission; the character, disposition, and capabilities of the enemy; the terrain; the availability of transportation; and the availability of supplies and equipment.

b. The tables shown in paragraph 48 indicate the numbers and types of combat and service units not organic to the divisions, which might be found in a typical army under average conditions. Such an army is presumed to have three corps of three infantry divisions and one armored division each. The table of organization and equipment is shown in paragraph 48 when the unit is a current type. When the unit listed is a proposed type, the table of organization and equipment of the most comparable current unit is shown in parentheses. In the application of these tables to a specific situation, modifications and adjustments must be made for variations in the composition or size of the force and any peculiarities of the particular situation.

c. The diagrams in paragraph 48 show the schematic layout of the units and the general areas of their operation. They are not intended to show the attachment or assignment of units to corps and divisions except in a very general way, and they are not intended to show the exact location of units.

48. Troop Requirements, Typical Army

a. Armored Units—Numbers and Types.

	1	2	3	4	5
1	Unit	TOE	Corps	Army	Total Army
2	Armd Cav Regt.....	17-51	1	1	4
3	Hq & Hq Co. Armd Cav Op.....	17-32A	1		3
4	Tk Bn Heavy 120-mm Oun ¹	17-35	3		9
5	Amph Tk Bn ²	17-115A			
6	Amph Trac Bn ²	17-125A			

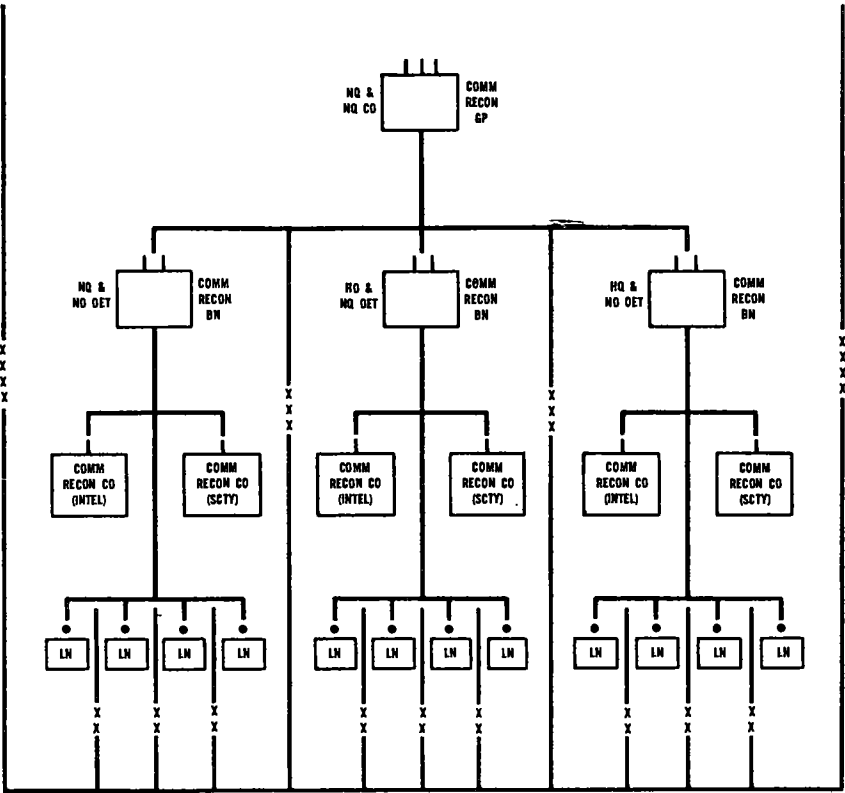
¹ Substitute Tk Bn 90-mm gun.

² As required for amphibious operations.

b. Army Security Agency Units.
(1) Numbers and types—Army Security Agency Units.

	1	2	3	4	5
1	Unit	TOE	Corps	Army	Total Army
2	Hq & Hq Co Comm Recon Gp.....	32-500	-----	1	1
3	Hq & Det Comm Recon Bn.....	32-500	1	-----	3
4	Comm Recon Co (Intel).....	32-500	1	-----	3
5	Comm Recon Co (Scty).....	32-500	1	-----	3

(2) Schematic diagram—Army Security Agency Units.



c. *Artillery Units.*(1) *Number and types.*

	1	2	3	4	5
1	Unit	TOE	Corps	Army	Total Army
2	Hq & Hq Btry, Corps Arty.....	6-501A	1	0	3
3	Hq & Hq Btry, FA Gp.....	6-401	4	0	12
4	FA Obsn Bn.....	6-575	1	0	3
5	FA Searchlight Btry.....	6-558A	1	0	3
6	Hq & Hq Btry, AAA Brig.....	44-101A	0	1	1
7	Hq & Hq Btry AAA Gp.....	44-12A	2	3	9
8	AAA Opns Det.....	44-7A	1	1	4
9	AAA AW Bn, Mbl.....	44-25A	0	6	6
10	AAA AW Bn, SP.....	44-75	3	0	9
11	AAA Gun Bn, 90-mm.....	44-15A	2	3	9
12	AAA Bn L, 75-mm, Mbl.....	44-35A	4	4	16
13	FA Bn, 4.5 in. Rocket.....	6-615	1	0	3
14	FA Bn, 105-mm How, SP, Armd.....	6-315	1	0	3
15	FA Bn, 155-mm How, Towed.....	6-135	2	0	6
16	FA Bn, 155-mm How, Sp, Armd.....	6-325	2	0	6
17	FA Bn, Towed, Hv, 155-mm Gun.....	6-415A	1	0	3
18	FA Bn, Hv, SP, 155-mm Gun.....	6-435A	1	0	3
19	FA Bn, Hv, Towed, 8 in. How.....	6-415A	2	0	6
20	FA Bn, Hv, Sp, 8 in. How.....	6-435A	2	0	6
21	FA Bn, VH, Towed, 240-mm How.....	6-515A	2	0	6
22	FA Bn, 280-mm Gun.....	6-535A	0	2	2
23	Arty Rocket Btry.....	6-538A	0	2	2
24	Guided Missiles Bn SSM, Corporal (Tent).....	6-545A	1	1	4
25	Guided Missiles Bn SAM.....	Proposed	0	1	1

c. *Artillery Units.*(1) *Number and types.*

	1	2	3	4	5
1	Unit	TOE	Corps	Army	Total Army
2	Hq & Hq Btry, Corps Arty.....	6-501A	1	0	3
3	Hq & Hq Btry, FA Gp.....	6-401	4	0	12
4	FA Obsn Bn.....	6-575	1	0	3
5	FA Searchlight Btry.....	6-558A	1	0	3
6	Hq & Hq Btry, AAA Brig.....	44-101A	0	1	1
7	Hq & Hq Btry AAA Gp.....	44-12A	2	3	9
8	AAA Opns Det.....	44-7A	1	1	4
9	AAA AW Bn, Mbl.....	44-25A	0	6	6
10	AAA AW Bn, SP.....	44-75	3	0	9
11	AAA Gun Bn, 90-mm.....	44-15A	2	3	9
12	AAA Bn L, 75-mm, Mbl.....	44-35A	4	4	16
13	FA Bn, 4.5 in. Rocket.....	6-615	1	0	3
14	FA Bn, 105-mm How, SP, Armd.....	6-315	1	0	3
15	FA Bn, 155-mm How, Towed.....	6-135	2	0	6
16	FA Bn, 155-mm How, Sp, Armd.....	6-325	2	0	6
17	FA Bn, Towed, Hv, 155-mm Gun.....	6-415A	1	0	3
18	FA Bn, Hv, SP, 155-mm Gun.....	6-435A	1	0	3
19	FA Bn, Hv, Towed, 8 in. How.....	6-415A	2	0	6
20	FA Bn, Hv, Sp, 8 in. How.....	6-435A	2	0	6
21	FA Bn, VH, Towed, 240-mm How.....	6-515A	2	0	6
22	FA Bn, 280-mm Gun.....	6-535A	0	2	2
23	Arty Rocket Btry.....	6-538A	0	2	2
24	Guided Missiles Bn SSM, Corporal (Tent).....	6-545A	1	1	4
25	Guided Missiles Bn SAM.....	Proposed	0	1	1

d. Chemical Units.

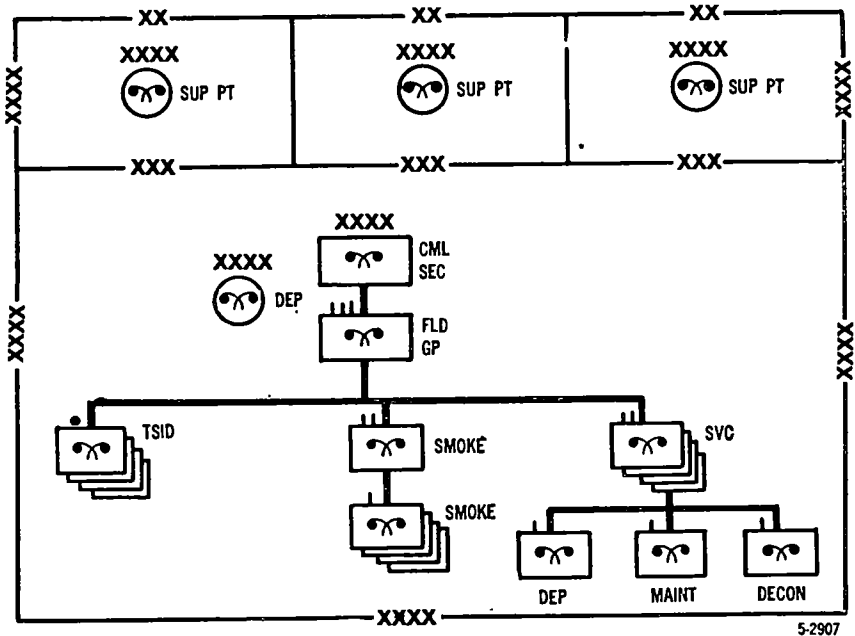
(1) Number and types—chemical units.

	1	2	3
1	Unit	TOE	Total Army
2	Hq & Hq Det, Cml Op (Fld).....	3-32A	1 1
3	Hq & Hq Det, Cml Smoke Genr Bn.....	3-266A	1
4	Cml Smoke Genr Co.....	3-267A	4
5	Hq & Hq Det, Cml bn (Sve).....	3-36A	3 4
6	Cml Maint Co.....	3-47A	4
7	Cml Depot Co.....	3-67	4
8	Cml Decon Co.....	3-217A	4
9	Cml Sve Detachments.....		
10	TSIT, IB.....	3-500A	1
11	TSIT, IA.....	3-500A	3
12	Cml Wpns Bn.....	Proposed	4

¹ For command of two to six battalions.

² For command of two to six companies such as chemical depot company, chemical decontamination company, chemical maintenance company and assigned units.

(2) Schematic diagram—chemical units.



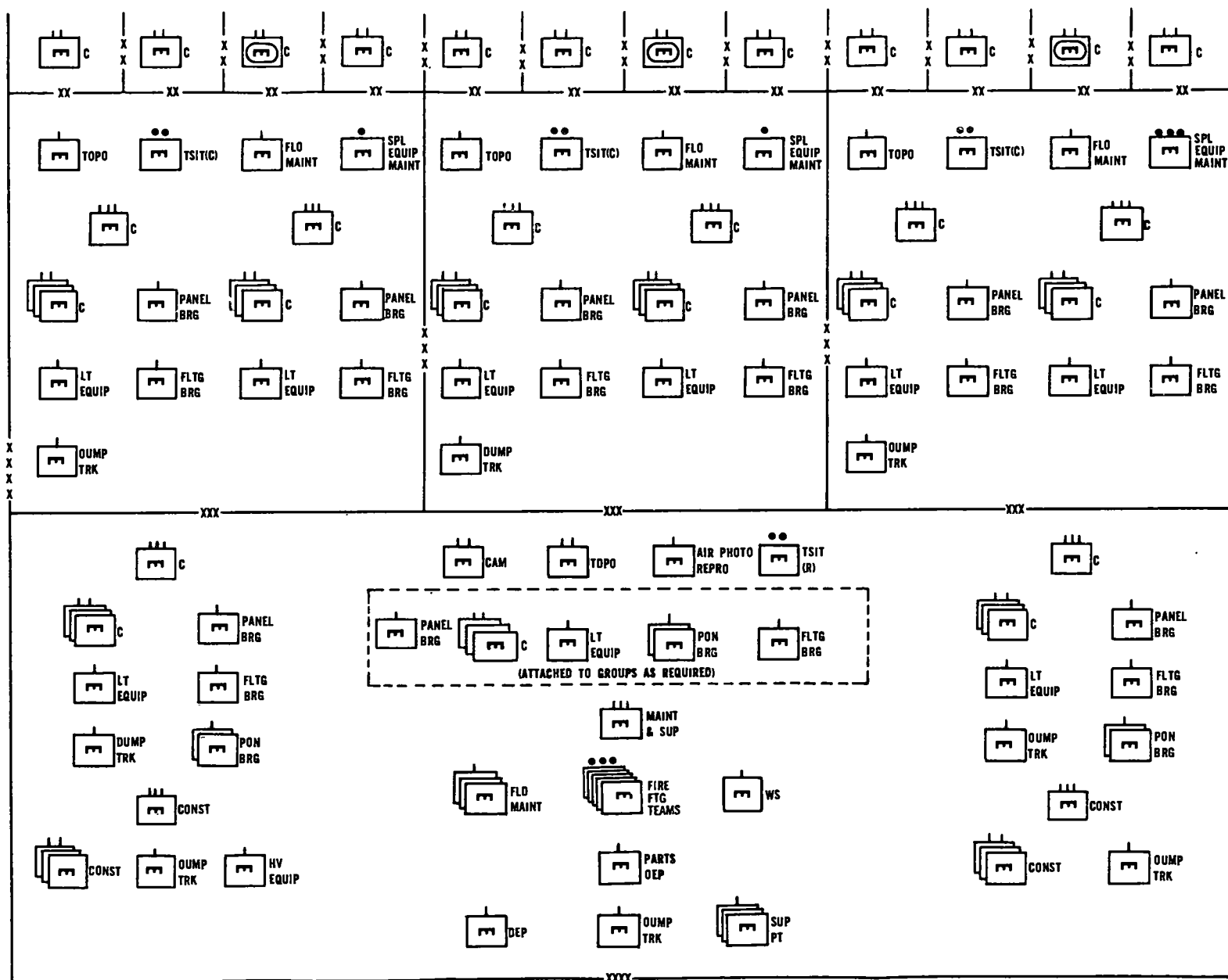
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e. Engineer Units.

(1) *Numbers and types—engineer units.*

1	1	2	3
	Unit	TOE	Total Army
2	Engr Cam Bn, Army.....	5-96	1
3	Hq & Hq Co, Engr C Gp.....	5-192	8
4	Engr C Bn, Army.....	5-35	27
5	Hq & Hq Co, Engr Const Gp.....	5-312	2
6	Engr Const Bn.....	5-315	6
7	Engr Dp Trk Co.....	5-324	8
8	Engr Hv Equip Co.....	5-328	1
9	Engr L Equip Co.....	5-367	9
10	Engr Fltg Brg Co.....	5-138	9
11	Engr Pnl Brg Co.....	5-137	9
12	Engr Pon Brg Co.....	5-139	6
13	Engr Aerial Photo Repro Co.....	5-54	1
14	Engr Topo Bn, Army.....	5-55	1
15	Engr Topo Co, Corps.....	5-167	3
16	Engr Maint & Sup Gp.....	5-262	1
17	Engr Dep Co.....	5-267	1
18	Engr Sup Pt Co.....	5-48	3
19	Engr Fld Maint Co.....	5-157	6
20	Engr WS Co.....	5-67	1
21	Engr Parts Dep Co.....	5-279	1
22	Engr F Ftg Team.....	5-500	5
23	Det, Spl Equip Maint.....	5-500	3
24	Engr Tech Intel Team (IG).....	5-500	3
25	Engr Tech Intel Team (IH).....	5-500	1
26	Engr Util Team (HF).....	5-500	1

(2) Schematic diagram—engineer units.



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f. Infantry Units—Numbers and Types.

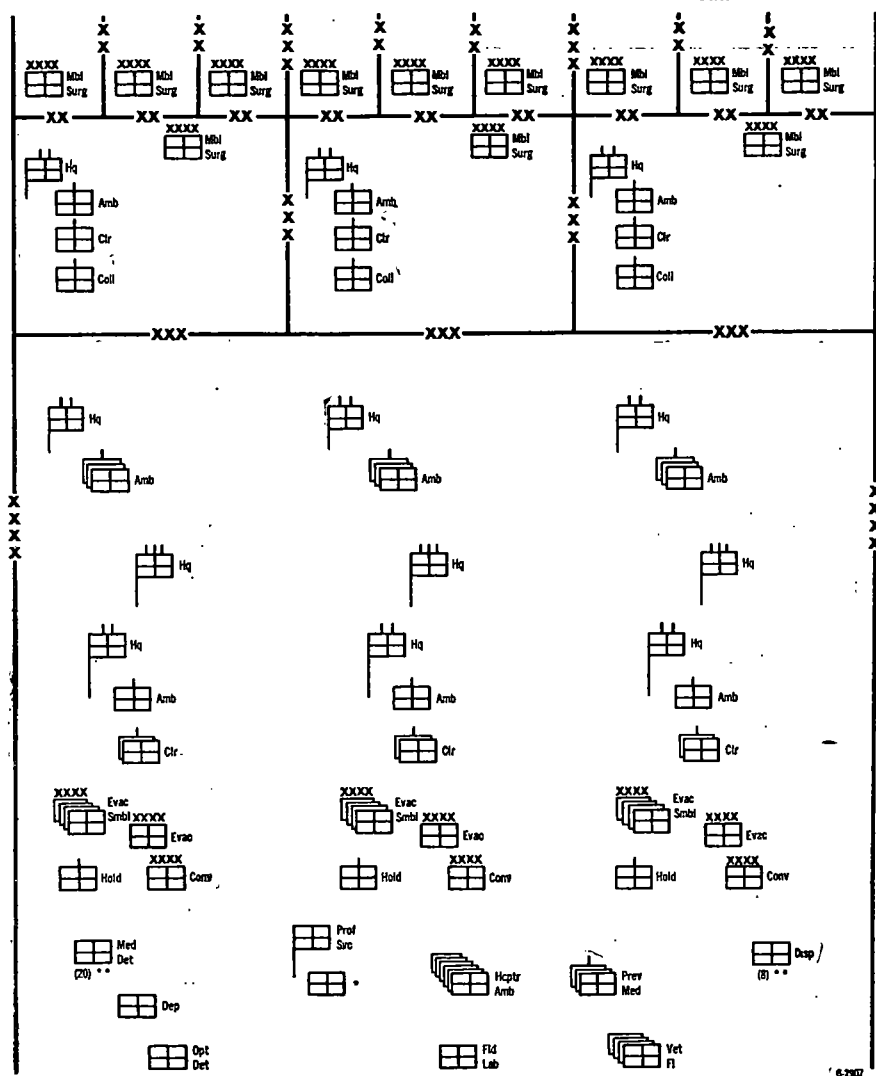
	1	2	3	4	5
	Unit	TOE	Corps	Army	Total Army
2	Regt, Sep.....	7-11		2	2
3	Inf Hv Mort Bn.....	7-45	1	1	4

g. Medical Units.

(1) Numbers and types—medical units.

	1	2	3
	Unit	TOE	Total Army
1	Hq & Hq Det, Med Gp.....	8-22R	3
2	Hq & Hq Det, Med Bn, Sep.....	8-26R	9
3	Med Coll Co, Sep.....	8-27R	3
4	Med Ctr Co, Sep.....	8-28R	9
5	Med Holding Co.....	8-57R	3
6	Med Amb Co, Sep.....	8-317R	15
7	Preventive Med Co.....	8-117R	3
8	Med Fld Lab, Army.....	8-640R	1
9	Army Med Depot.....	8-667A	1
10	Mbl Army Surg Hosp.....	8-571R	12
11	Evac Hosp, SmbL.....	8-581R	12
12	Evac Hosp.....	8-580R	3
13	Convalescent Center, Army.....	8-590R	3
14	Hq, Professional Svc (AG).....	8-500A	1
15	Surgical Det (KA).....	8-500A	24
16	— Orthopedic Det (KB).....	8-500A	6
17	Shock Det (KC).....	8-500A	12
18	Maxillo-Facial Det (KO).....	8-500A	3
19	Neurosurgical Det (KE).....	8-500A	3
20	Thoracic Det (KF).....	8-500A	6
21	Gas Det (KG).....	8-500A	4
22	Dental Svc Det (KJ).....	8-500A	8
23	Dental Prosthetic Det, Mbl (KK).....	8-500A	2
24	Psychiatric Det (KO).....	8-500A	4
25	Autmv Maint (DA).....	29-500A	3
26	Mess Det (AH).....	29-500A	1
27	Optical Det (GA).....	8-500A	1
28	Optical Det (Augmentation) (GB).....	8-500A	2
29	Vet Food Insp Det (JA).....	8-500A	4
30	Dispensary (MC).....	8-500A	8
31	Medical Det (OA).....	8-500A	20
32	Helicopter Amb Unit (RA).....	8-500A	6
33	Med Intell Det (QA).....	8-500A	4

(2) *Schematic diagram—medical units.*



- Prof Svc teams atch to surg and evac hosp as required.
- Provide area medical service.

h. Military Police Units—Numbers and Types.

	Unit	TOE	Total Army
1	MP Bn, Army.....	19-35A	3
2	MP Co, Corps and Army.....	19-37	4
3	MP Service Orgn (AD) (MA) (NA).....	19-500A	1
4	MP Esct Gd Co (Mbl).....	19-47A	3
5	MP Co (Gd) (Fxd).....	19-247A	2
6	CID (ME).....	19-500A	3
7	CID (MD).....	19-500A	1
8	Crime Lab (Mbl) (MG).....	19-500A	1

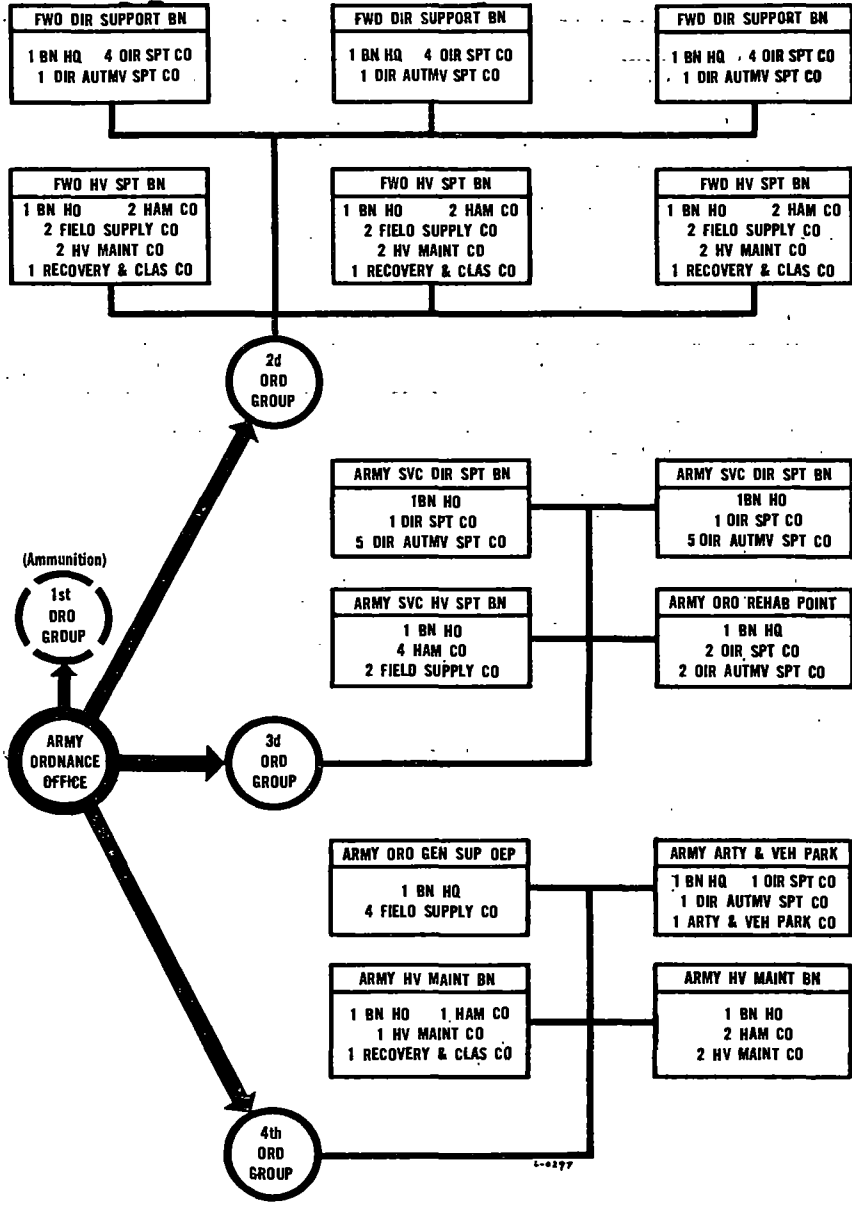
i. Ordnance Units.

(1) Numbers and types—ordnance units.

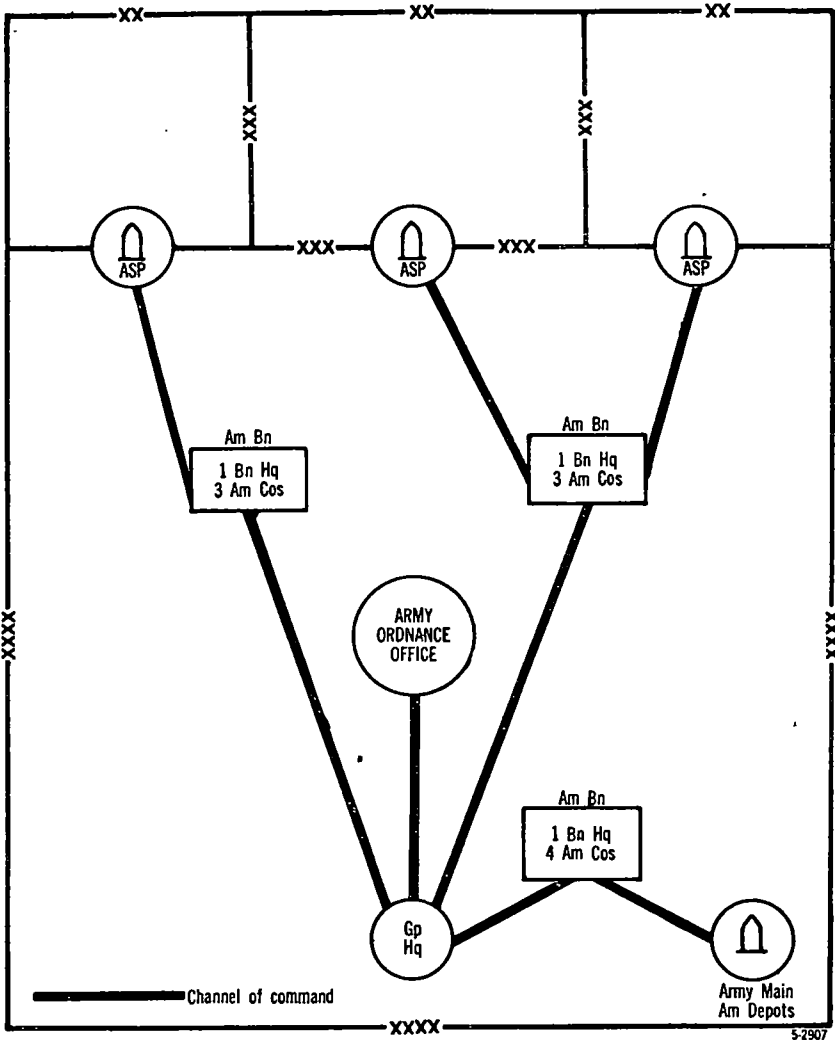
	Unit	TOE	Total Army
1	Hq & Hq Co, Ord Gp.....	9-12R	4
2	Hq & Hq Det, Ord Bn.....	9-76R	17
3	Ord Co, Direct Spt.....	9-7R	17
4	Ord Co, Direct Autmv Spt.....	9-127	16
5	Ord Hv Maint Co.....	9-9	9
6	Ord HAM Co.....	9-197	13
7	Ord Field Supply Co.....	9-57R	12
8	Ord Recov and Clas Co.....	9-167	4
9	Ord Arty & Veh Park Co.....	9-137A	1
10	Ord Ammo Co (Army).....	9-17	10
11	Ballistic and Tech Svc Det BA.....	9-510	1
12	EOD Det BA.....	9-510	8
13	EOD Control Det AC.....	9-510	1
14	Tech Intel Det BB.....	9-510	4
15	Integrated Fire Ctl Det*.....	9-510	15
16	Ord Sp Wpns Spt Bn.....	9-45A	1

*Type required based on Wpns supported.

(2) Schematic diagram—ordnance units.
(a) General supply and maintenance.



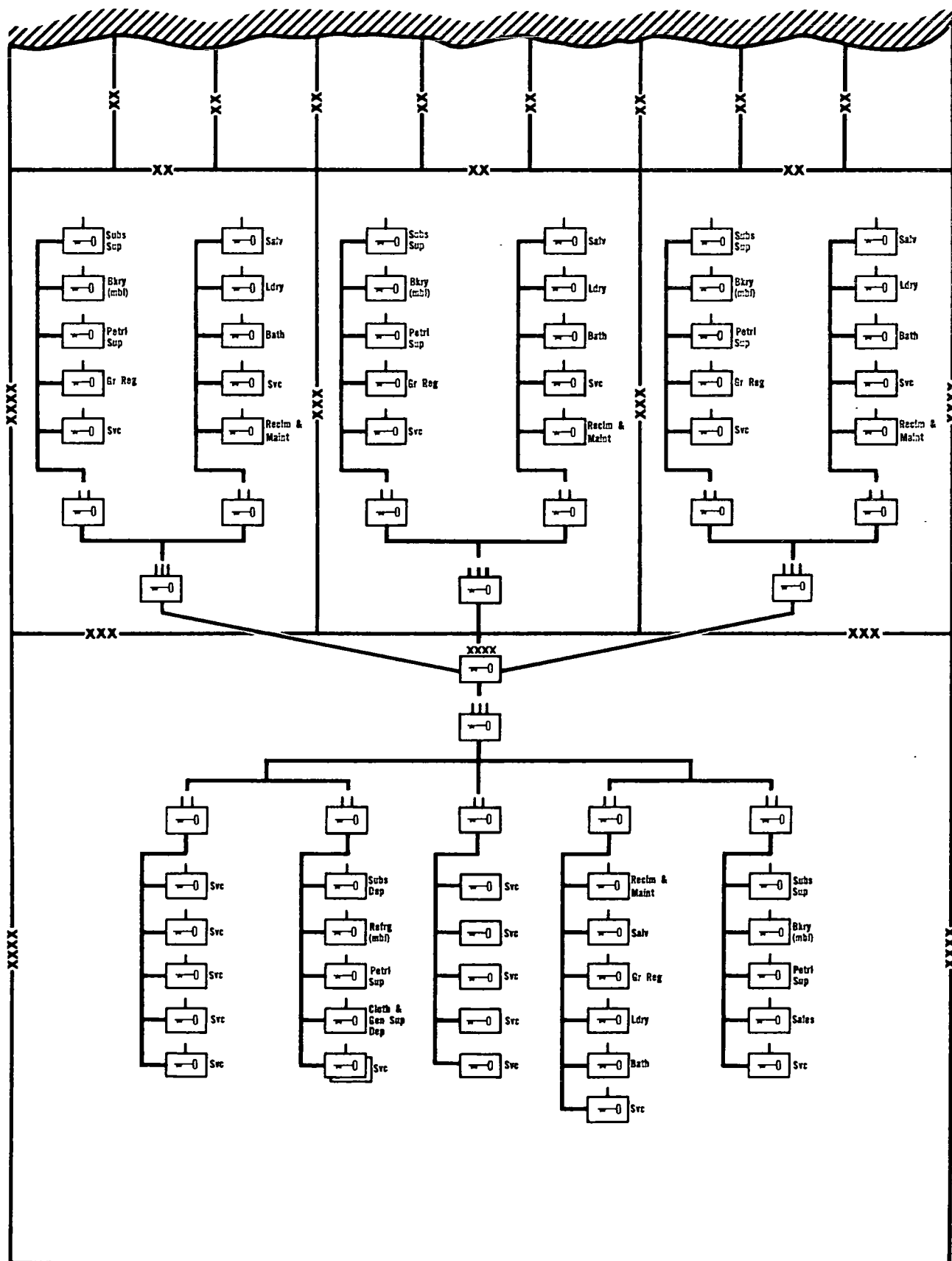
(b) Ammunition supply.



*j. Quartermaster Units.**(1) Numbers and types—quartermaster units.*

	Unit	TOE	Total Army
1	Hq & Hq Co, QM Gp.....	10-22	4
2	Hq & Hq Det, QM Bn.....	10-536	11
3	QM Bkry Co (Mbl).....	10-147	4
4	QM Clothing & Gen Sup Dep Co.....	10-227	1
5	QM Subs Dep Co.....	10-357	1
6	QM Ldry Co (Smb).....	10-167	4
7	QM Refrg Co (Mbl).....	10-247R	1
8	QM Sales Co, Mbl.....	10-157	1
9	QM Svc Co.....	10-67	20
10	QM Petrl Sup Co (Mbl).....	10-77	5
11	QM Bath Co (Smb).....	10-257	4
12	QM Gr Reg Co.....	10-297R	4
13	QM Rclm & Maint Co (Smb).....	10-237	4
14	QM Salv Co.....	10-187	4
15	QM Subs Sup Co.....	10-197	4

(2) Schematic diagram—quartermaster units.

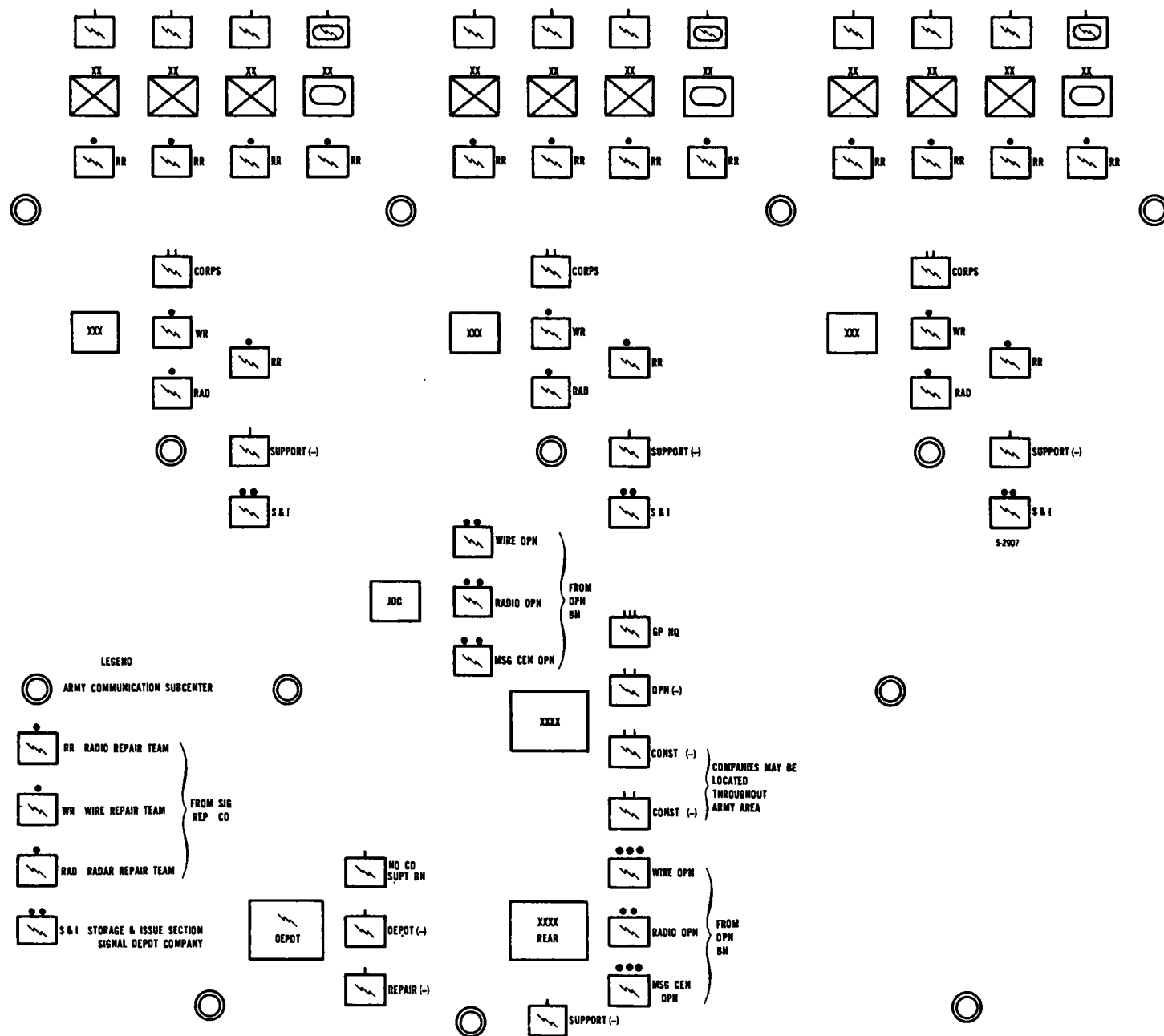


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(2) Schematic diagram—signal units.



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*k. Signal Corps Units.**(1) Numbers and types—signal units.*

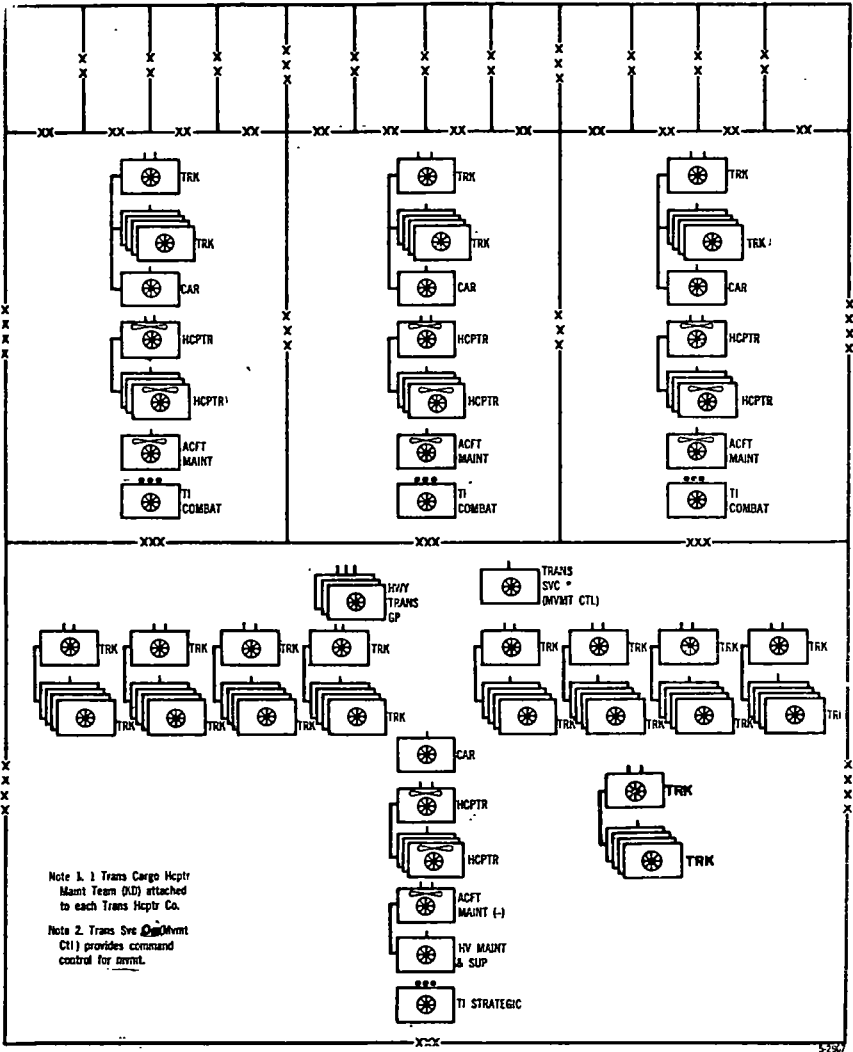
	1	2	3	4	5
1	Unit	TOE	Corps	Army	Total Army
2	Sig Bn Corps.....	11-15	1	0	3
3	Hq & Hq Co.....	11-16A	1	0	3
4	Rad & Msg Cen Opn Co.....	11-17A	1	0	3
5	Wire & Rad Relay Opn Co.....	11-18	1	0	3
6	Const Co.....	11-27A	3	0	9
7	Hq & Hq Det Sig Gp.....	11-22A	0	1	1
8	Sig Const Bn.....	11-25	0	2	2
9	Hq & Hq Co.....	11-26A	0	2	2
10	Const Co.....	11-27A	0	8	8
11	Sig Bn (Opn).....	11-95	0	1	1
12	Hq & Hq Co.....	11-96	0	1	1
13	Co (Wire Opn).....	11-97	0	1	1
14	Co (Rad Opn).....	11-98	0	1	1
15	Co (Msg Cen Opn).....	11-99	0	1	1
16	Hq & Hq Det Sig Spt Bn.....	11-116A	0	1	1
17	Sig Spt Co.....	11-117A	0	4	4
18	Rep Co.....	11-127	0	1	1
19	Dep Co.....	11-128A	0	1	1

l. Transportation Corps Units.
(1) Numbers and types.

	1	2	3
1	Unit	TOE	Total Army
2	Hq and Hq Co, Trans Hwy Trans Gp.....	55-12A	3
3	Hq and Hq Co, Trans Trk Bn.....	55-16A	12
4	Trans Light Trk Co.....	55-17	48
5	Trans Car Co.....	55-19A	4
6	Trans Amph Trk Co*.....	55-37	
7	Trans Svc Co (Mvmt Control).....	55-500A (1 AC, 1 LA, 9 LC, 9 LD, 5 LB).	1
8	Hq and Hq Det, Trans Hcptr Bn.....	55-56	4
9	Trans Hcptr Co.....	55-57	12
10	Trans Cargo Hcptr Field Maint team.....	55-500A	12
11	Hq and Hq Det, Trans Army Acft Maint Bn.....	55-456	1
12	Trans Army Acft Maint Co.....	55-457	3
13	Trans Army Acft Hvy Maint and Supply Co.....	55-458	1
14	Trans Intel Det.....	55-500A	
	Strategic.....	HB	1
	Combat.....	HA	3

*Two per division in amphibious operations.

(2) Schematic diagram—Transportation Corps units.



m. Miscellaneous Units—Number and Type.

1	Unit	TOE	Total Army
2	Hq, Army.....	51-1	1
3	Hq Co, Army.....	51-2	1
4	Hq, Spl Trp, Army.....	51-3	1
5	Hq, Corps.....	52-1A	3
6	Hq Co, Corps.....	52-2A	3
7	Hq & Hq Det, Repl Gp.....	20-52	1
8	Hq & Hq Det, Repl Bn.....	20-56	6
9	Repl Co.....	20-57	24
10	M. R. Unit, Type Z, with Augmentation.....	12-510	5
11	Army Postal Unit, Type Z.....	12-605	1
12	Army Postal Unit, Type R.....	12-605	3
13	Army Postal Unit, Type V.....	12-605	3
14	Army Postal Unit, Type W.....	12-605	3
15	Army Postal Unit, Type Y.....	12-605	6
16	Base Post Office, Type S.....	12-520	1
17	Fin Disbursing Sec (AD; BP; CB; DC).....	14-500A	6
18	Spl Sve Co.....	12-17	4
19	Det, CIC (AA; FA).....	30-500A	12
20	Det, CIC (AB; FB).....	30-500A	3
21	Det, CIC (AC; FC).....	30-500A	1
22	Strategic Intel Det (Research and Analysis).....	30-520A	1
23	Mil Intel Bn (Army).....	30-600	1
24	Mil Govt Op.....	*41-500A	1
25	Mil Govt Co (AB).....	*41-500A	6
26	Mil Govt Plat (AA).....	*41-500A	12
27	Loudspeaker & Leaflet Co.....	20-77A	1
28	Orgn or Sep Band.....	12-107	1
29	Mil Hist Det.....	20-17A	4

*Strength figures do not include operational personnel which is variable.

49. Troop Requirements—Communications Zone

Troop requirements in a communications zone vary with the strength supported, the topography, the climate, and the development of the theater. Variation is so great that no type organization of troop units is shown in this paragraph. An outline plan for preparing a communications zone troop list follows.

a. Determine the mission of the communications zone.

- (1) Determine the supported strength. Both the number and type of divisions and supporting combat and service troops within the combat zone must be known. The extent of support required for troops of other services (Navy (including Marine) and Air Force) for allied troops, and civil affairs or military government must be determined.
- (2) Study the mission of the theater to determine the load which will be placed on the communications zone. An active theater requires more communications zone troops than a defense command.

b. Study the territory which will comprise the communications zone. Lines of communications, geography, climate, and extent of development all affect the troop list. A survey or estimate of probable destruction from enemy or other causes must be made.

c. Study the political organization, economy, density of population, probable attitude of the inhabitants, and extent of destruction of their installations and local government. Determine whether population will be controlled by military government or by civil affairs support of an existing government. Determine the size and composition of a military government staff for the communications zone headquarters as well as of a national military government headquarters for each nation in the communications zone. Determine needs for military government units by type of occupation and by major and minor political subdivisions of each country. Determine the requirements for psychological warfare forces for an effective consolidated propaganda program. Economy of personnel and established doctrine dictate adherence to existing political boundaries and governmental structure in determining military government requirements.

d. Determine a tentative organization of communications zone to include any necessary division into base, intermediate, or advance sections. The logistical command is a suitable nucleus for a communications zone section.

e. Add technical and other service troop units to the headquarters and headquarters company, logistical commands, as required for the accomplishment of the assigned missions.

f. Each service having been provided with an adequate troop list to accomplish its primary mission, check the troop list to insure that it includes the following units for installations and headquarters involving more than one service.

- (1) *Adjutant general service.* Postal units at each major headquarters, port, depot, staging area, and recreation area.
- (2) *Engineer service.* Utilities detachments at each major headquarters, port, general depot, staging area, and recreation area. Fire-fighting detachments at each city, port, hospital, and troop camp.
- (3) *Finance service.* Finance disbursing sections at each major headquarters, hospital, port, and troop camp.
- (4) *Military police service.* Gate detachments at each major headquarters, hospital, port, and depot. Guard detachments for each train, Military Railway Service.

- (5) *Quartermaster service.* Laundry detachments at each recreation area, staging area, and troop camp. Quartermaster service companies may be added to port and depot troop lists to increase their capacity with greater economy in trained manpower than would result if additional port companies, depot companies, and ammunition companies were added.
- (6) *Signal service.* Signal operations detachments at each major headquarters, port, hospital, depot, and troop camp.
- (7) *Transportation service.* Transportation car companies for major headquarters. Transportation truck units for depots, staging areas, ports, and recreation areas.
- (8) *Bulk allotment.* Sufficient bulk allotment must be provided to furnish personnel for the many headquarters and special organizations, not provided for in tables of organization and equipment. Normally the communications zone headquarters itself is chargeable against the bulk allotment. Headquarters for intersectional services may require tables of distribution from the bulk allotment. Each communications zone section will require a suballocation from the bulk allotment for the organization of district headquarters and recreation area headquarters, and for other special tasks.

g. Make a final check comparing the services to insure that they are balanced with each other.

h. Troop requirements for defense of communications zone installations, facilities, and lines of communications will vary with the terrain, size of the area, the local political situation and the enemy airborne, amphibious, and guerilla capability. Forces such as armored cavalry regiments, separate infantry regiments and battalions will be required. Locally recruited home guard units may be utilized to augment the above military forces. Divisional size units located in the communications zone may be used as defense forces in an emergency, however such employment would be by direction of the Theater Army Commander.

i. Figures on division slices are given in paragraph 53*a*. Figures on air wing slices are given in paragraph 53*b*. The total strength of the communications zone troop list should approximate the sum of the communications zone portions of the division slices and the air wing slices. The following figures are given as a further guide:

- (1) Advance section supporting an independent corps and operating a port, a small military railway service, and an area 50 miles deep by 20 miles wide; 35,000 to 50,000 total; a figure of 40,000 may be used as an early approximation.

- (2) Advance section supporting a balanced field army, and operating a port, a military railway service, and an area 50 miles deep by 50 miles wide: 75,000 to 110,000; a figure of 90,000 may be used as an early approximation.

50. Troop Requirements—Airborne Operations

a. General.

- (1) The troop requirements for an airborne force are determined by the number of airborne and infantry divisions assigned; the mission; the terrain and weather in the objective area; enemy dispositions and capabilities; availability of aircraft; probable length of time the airborne force must be supported by air lines of communication; the availability of logistical and administrative support; and other pertinent factors. The complete dependence of an airborne force on a single communication system—air lines of communication—until surface link-up is established, requires that troop requirements be very carefully determined for each specific airborne operation being planned.
- (2) Normally the troop list for the Army component of an airborne force includes those units that will be directly employed in the operation in a combat or supporting role, and does not include units required for the marshalling of the Army forces, or the logistical or administrative support that may be furnished by the communications zone agency designated to mount and support the airborne operation.
- (3) The number of airborne divisions and corps allocated to theaters of operation will vary. Such units will be furnished by the Department of the Army based on Joint Chiefs of Staff directives.
- (4) The Army component of an airborne force is usually responsible for its own logistical support in the airborne objective area, regardless of the size or composition of the Army forces. Therefore, the troop list for the Army component of an airborne force will contain sufficient service troops to provide logistical support in the airborne objective area. In all airborne operations the provision of service support to the Army forces in the objective area by units located in the departure area will be carefully considered and used to the maximum extent permitted by the characteristics of the operation being planned. Usually the nature of the service provided by the units concerned will determine whether they

will be assigned to the Army component of the airborne force or to the communications zone agency supporting the operation. Normally the number of Army service troops required in an airborne objective area will be considerably less than the number employed by a ground force containing the same number of divisions.

b. Employment of TOE Units. The same types of combat and service troops shown for the typical field army in paragraph 48 will be used to support airborne divisions, infantry divisions, corps and armies used in airborne operations. The number of supporting units used will be scaled down to provide only the requirements of the specific force being organized. Frequently the strength and organic equipment of a supporting unit will be reduced to enhance its air transportability. Lighter equipment may be substituted for heavy equipment. Because of the inherent differences between ground and airborne operations, many of the units shown in paragraph 48 may be omitted from the airborne troop list while others may be assigned to the communications zone agency supporting the airborne operation. Of those units assigned to the Army component of the airborne force, a portion may operate within the objective area while others will support the operation from the departure area.

c. Employment of Special Units. Special units or TOE units with special training and equipment are required for certain airborne operations, particularly those of the independent type.

- (1) Engineer construction battalions which have been specially equipped and trained for airfield construction are required when airfields must be repaired or constructed during the early stages of an airborne operation.
- (2) Specially organized, trained, and equipped units are required to provide air terminal facilities in the airhead when large tonnages of supplies and equipment will be delivered by air for a prolonged period. Normally this support will be provided by Air Force units.
- (3) The number and types of the special units required will be determined separately for each airborne operation based on such factors as the airfield repair and construction requirements in the objective area; the tonnage of supplies and equipment to be received in the objective area via air transportation; and the method of supply distribution that will be used in the objective area.

51. Troop Requirements—Amphibious Operations

The table shown below is designed to determine the units required in addition to the units organic and normally attached to regimental combat teams, divisions, and corps to provide a balanced shore party

troop list for an amphibious assault. Troop assignment (in the table) is based on a corps with three divisions in the assault. The factors used as a basis for determining the troop requirements can only be used to provide an estimate of requirements. Modifications and adjustments must be made to meet the peculiarities of a particular situation.

Typical Shore Party Troop List

	1	2	3	4	5
1	Unit	TOE	Per ROT ^{1 2}	Per Inf Div ^{1 2}	Per Corps ^{1 2}
2	Hq & Hq Co, Amphibious Support Brigade (ASB). ³	20-301A	-----	-----	1
	Engineer Units:				
3	Amph Spt Regt, ASB. ³ -----	20-511	-----	1	3
4	Engr Shore Bn. ³ -----	5-525A	-----	1	3
5	Engr Shore Co. ³ -----	5-527A	1	-----	-----
6	Engr Fld Maint Co, ASB. ³ -----	5-157	-----	-----	1
7	Engr Combat Bn (Army)-----	5-35A	-----	1	3
8	Engr Combat Co.-----	5-37A	1	-----	-----
9	Engr Sup Pt Co.-----	5-48A	-----	1	3
10	Engr Lt Equip Co.-----	5-367A	-----	-----	1
	Chemical Units:				
11	Cml Smoke Genr Co.-----	3-267A	-----	1	3
12	Cml Sup Det.-----	3-500A	-----	1	3
	Medical Units:				
13	Med Det, ASB. ³ -----	20-300A	-----	-----	1
14	Med Bn (Sep). ³ -----	8-26A	-----	-----	1
15	Med Amb Co (Sep)-----	8-317A	-----	-----	1
16	Med Cir Co (Sep)-----	8-28A	-----	-----	1
17	Med Coll Co (Sep)-----	8-27A	-----	-----	1
	Ordnance Units:				
18	Ord Maint Co, ASB. ³ -----	9-97A	-----	-----	1
19	Ord Dir Spt Co.-----	9-127	-----	-----	1
20	Ord Field Sup Co. ³ -----	9-57A	-----	-----	1
21	EOD Sqd.-----	9-500	-----	1	3
22	Ordnance Ammo Co. ³ -----	9-17	-----	-----	1
	Signal Units:				
23	Signal Co, ASB. ^{3 4} -----	11-537A	-----	-----	1
24	Signal Depot Co.-----	11-500A	-----	1	3
	Quartermaster Units:				
25	QM Co, ASB. ³ -----	10-277AR	-----	-----	1
26	QM Svc Co.-----	10-67R	-----	1	4
27	Hq & Hq Det, QM Bn.-----	10-536R	-----	1	3
28	QM Subs Sup Co.-----	10-197AR	-----	1	3
29	QM Petrl Sup Co (Mbl)-----	10-77R	-----	1	3
	Transportation Units:				
30	Trans Boat Bn, ASB. ^{3 4} -----	55-515A	-----	1	3
31	Trans Boat Co. ³ -----	55-517A	1	-----	-----
32	Trans Boat Maint Bn, ASB. ^{3 4} -----	55-555A	-----	-----	1
33	Trans Boat Maint Co. ³ -----	55-557A	-----	1	-----
34	Trans Harbor Craft Co, ASB.-----	55-9A	-----	-----	1
35	Hq & Hq Co, Trans Trk Bn. ³ -----	55-16A	-----	1	3
36	Trans Lt Trk Co.-----	55-17	-----	2	6
37	Trans Amph Trk Co.-----	55-37	-----	2	6
38	Hq & Hq & Svc Co, Trans Terminal Service Bn.-----	55-116A	-----	1	3
39	Trans Terminal Service Co.-----	55-117A	1	3	9

See footnotes at end of table.

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Typical Shore Party Troop List—Continued

	1	2	3	4	5
1	Unit	TOE	Per RCT ^{1 2}	Per Inf Div ^{1 2}	Per Corps ^{1 2}
	Military Police Units:				
40	Military Police Bn, Army.....	19-35A	-----	-----	1
41	Military Police Co, Corps and Army.....	19-37	-----	1	3
42	Military Police PW Guard Det.....	19-500A	-----	1	3
	Navy Units:				
43	Naval Beach Group ⁷	USN	-----	1	3
	Air Force Units.....		-----	(⁸)	(⁸)

¹ TOE units shown under columns 4 and 5 can be broken down and assigned to support subordinate commands as the situation may require.

² Figures in column 4 include those in column 3, figures in column 5 include those in column 4.

³ Units organic to ASB. Remaining units are normal attachments to the ASB when acting as the shore party for a corps in amphibious operations.

⁴ Detachments may be attached to divisions when ASB headquarters is not employed.

⁵ Detachments usually attached to divisions.

⁶ Organic to amphibious support regiment.

⁷ Less boat unit if ASB boats are employed.

⁸ Air Force service elements to support Air Force units with the landing force.

52. Troop Planning Slices

a. Purpose. In logistical planning, a preliminary estimate of the total size of a force is required in order to determine the final composition and the ultimate size of the force, for the required number of many service units, such as hospitals, depot units, etc., bears a direct relationship to the size of the total force. Two factors are used in such planning, the *division slice* and the *wing slice*. To determine the preliminary total of the force, multiply the division slice by the number of divisions in the force and add the product thus obtained to that of the wing slice multiplied by the number of wings in the force; to the sum thus obtained must be added the various miscellaneous forces not included in either slice.

b. Definitions.

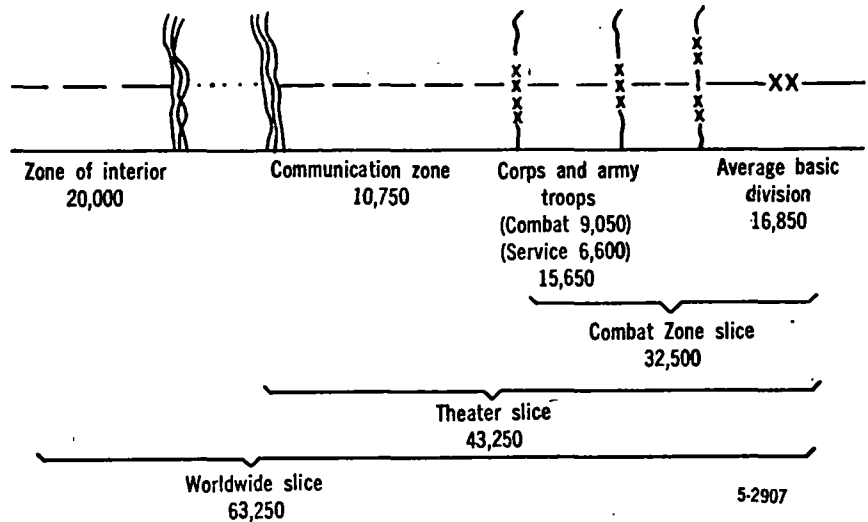
- (1) The *division slice* includes the strength of an average combat division plus proportionate shares of the total corps, army, communications zone, and zone of interior (for world-wide slice only) units operating to the rear of the division (and of Naval units directly supporting the Marines in case of Marine divisions). The division slice for any given force is equal to the total strength of the force divided by the number of combat divisions in the force.
- (2) The *wing slice* includes the strength of an average wing plus a proportionate share of the Air Force and Army units engaged in developing or operating the air bases (and of Naval units which directly support the Marine or Naval Air units).

c. Relation Between Division Slice and Wing Slice. The 7,000-man wing slice includes about 1,000 Army communications zone men not

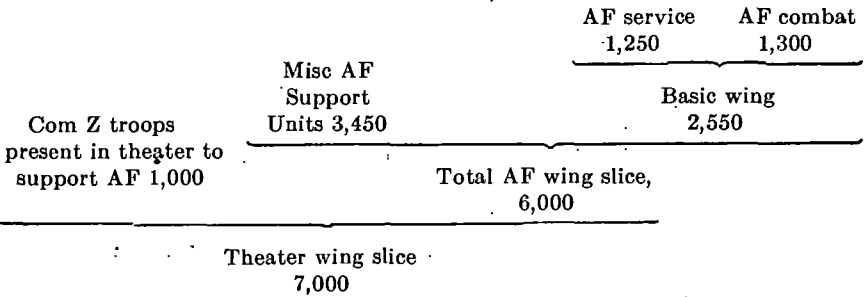
counted in a division slice. These 1,000 Army men are required for communications zone support of Air Force units and installations present in the theater of operations. In the charts in paragraph *d* below, and in *a* and *b* above, this same assumption is made: the wing slice and not the division slice contains the communications zone support for Air Force. This allows troop planners to use these tables with varying ratios of air wings to Army divisions in any specific force.

d. Basic Slice Factors. (See pars. 124 and 265 for location of slice components as contrasted with assignment of slice components shown here.)

(1) *Division slice* (U.S. Army troops only).



(2) *Wing slice* (U.S. Air Force combat service and support troops and U.S. Army troops present because Army supports Air Force in certain functions):



(3) *Amphibious assault and buildup.* Initially in an amphibious assault, all elements are smaller than shown in (1) and (2) above and reach the strength shown there gradually during

buildup. Division slices varying from 22,000 to 30,000 men have proved satisfactory in the long range planning estimation of strengths for an amphibious assault including followup. The value of 25,000 is recommended for general planning purposes. The number of vehicles to be landed with assault troops is estimated on the basis of 1 vehicle per 10 men for long voyages, 1 vehicle per 7 men for short voyages (due to differences in types of shipping). Division slices varying from 35,000 to 40,000 men have proved satisfactory in the estimation of peak strengths, achieved between D+30 and D+90, in an amphibious operation. The value of 40,000 men is recommended for general planning purposes. The number of vehicles to be landed in buildup for a force is estimated on the basis of providing enough to increase the ration of vehicles per man to 1 vehicle to 5 or 6 men of the total (assault and buildup) force.

Division Slice

Branch or other major groupings	World-wide slice		Theater slice		Combat zone slice		Average division only (16,850 men)
	Total (63,250 men)	Z/I portion (20,000 men)	(Army)		(Army)		
			Total (43,250 men)	ComZ portion (10,750 men) ¹	Total (32,500 men) ²	Corps and Army—rear portion (15,650 men) ²	
Combat Division.....	26.6	0	39.0	0	51.8	0	100
Hq units, AG, FD, Spl, Sv, and other administrative and intelligence services including operating overheads (including for Z/I defense command overheads and Dept of Army agencies).....	5.5	9.5	3.7	8.4	2.2	4.5	0
Armor.....	2.5	.3	3.5	.1	4.6	9.6	0
Artillery.....	7.7	1.6	10.6	.1	14.1	29.2	0
Chemical.....	.5	.2	.6	.7	.6	1.2	0
Engineer.....	7.7	4.0	9.0	12.0	8.5	17.7	0
Military Police.....	1.1	.9	1.2	2.0	.9	1.9	0
Infantry.....	1.5	.4	2.3	.2	2.5	5.2	0
Medical.....	5.9	4.9	6.5	16.0	3.3	6.8	0
Ordnance.....	4.0	1.8	5.0	6.9	4.3	9.0	0
Quartermaster.....	4.7	2.6	5.6	14.7	2.6	5.4	0
Signal.....	2.8	1.7	3.3	7.0	2.1	4.4	0
Transportation.....	5.6	5.0	6.0	16.2	2.5	5.1	0
Replacements.....	10.0	23.0	3.7	¹ 15.7	² (2.3)	² (4.9)	0
Bulk Pers Z/I only.....	8.8	27.9	0	0	0	0	0
Misc Z/I only.....	5.1	16.2	0	0	0	0	0
Total percent.....	100	100	100	100	100	100	100
Percentage of world-wide slice.....	100	31.6	68.4	17.0	51.4	24.8	26.6
Percentage of theater slice.....			100	24.8	75.2	36.2	39.0
Percentage of combat zone slice.....					100	48.2	51.8

¹ Includes replacements in field army area.

² Does not include replacements.

³ Not included in field army percentage total.

53. Division and Wing Slices

a. Division Slice. The following table presents the percentages of each arm, service, and other major grouping in each part of a large balanced force. It is based on troop deployment at the end of World War II. This troop deployment contained 89 divisions: 5 airborne, 16 armored, 1 cavalry, 66 infantry, and 1 mountain. This table has been modified to conform to the current type field army, current divisions and the consolidation of all artillery in one arm, the consolidation of cavalry, armored, and tank destroyer units into one armor branch, the transfer of certain truck and car units from Quartermaster Corps to Transportation Corps, and the separation of the Air Force from the Army. The communications zone column does *not* include those Army communications zone troops who must be present to support the Air Force (see par. 52*b* and *c*).

b. Wing Slice. This table presents the percentages of components, branch, and other major groupings present in the theater of operations. It is based upon a hypothetical USAF troop list and a hypothetical Army force.

Theater Wing Slice

	1	2	3	4
1	Component, branch, or other major grouping	Theater total 7,000 men	Air Force total 6,000 men	Basic Wing 2,550 men (1,300 combat) (1,250 service) ¹
	Air Force:			
2	Hq and overhead ²	3.0	3.3	-----
3	Combat.....	25.8	30.0	51.0
4	Service.....	24.7	29.0	49.0
5	Misc support.....	32.2	37.7	-----
	Army:			
6	ComZ support.....	14.3	-----	-----
7	Total percent.....	100.0	100.0	100.0
8	Percent of wing slice.....	100.0	85.7	36.4

¹ Located on the combat airfield, includes all elements organic to wing.

² Includes various Air Force headquarters and miscellaneous overhead units.

Section II. TACTICAL TROOP MOVEMENTS

54. Movement on Foot

a. Introduction. Troop movement data as given in tables of basic road spaces and tables of rates and lengths of marches are averages from field experience.

Examples: Examples of forms for troop movement tables are included as guides for the preparation of similar tables for units in the field. Tables for field use must conform to the variations of strength of units and the amount of transportation and equipment

available. Regiments, separate battalions, and similar units should maintain tables showing road space requirements of their units based on actual strength and material on hand. Reports of subordinate units form the basis for tables of large units. However, a table based on actual strength of men and material may be worthless without proper evaluation of the weather, road conditions, hostile air and mechanized threats, or other variable factors affecting the troop movement. These basic figures are capable of great increase or decrease under extremes of the variable factors.

b. Basic Road Spaces. The following values apply in computing road spaces except when greater dispersion is desired to reduce the effect of unfavorable factors mentioned in *a* above:

(1) *Foot troops (at halt or marching):*¹

	Yards
Single file, per man.....	2. 3
Single file, tactical conditions, per man.....	5. 3
In column of twos, per man.....	1. 5
In column of threes, per man.....	1. 3
In column of fours, per man.....	1. 2

(2) *Motor elements (at halt):*²

	Road space (yards) ³
Car, passenger.....	8
Half-track or armored personnel carrier.....	8
Tank.....	8
Tank with cargo trailer or weapon in tow.....	11
Tractor, M-18.....	7
Tractor, M-18 with cargo trailer or weapon in tow.....	15
Tractor, 5-ton with semitrailer 10-ton, 25; S & P.....	14
Trucks:	
¼-ton.....	5
¼-ton with cargo trailer or weapon in tow.....	8
½- or ¾-ton.....	6
½- or ¾-ton with cargo trailer or weapon in tow.....	10
1½- or 2½-ton.....	9
1½- or 2½-ton with cargo trailer or weapon in tow.....	16
Over 2½-ton.....	9
Over 2½-ton with cargo trailer in tow.....	13
6-ton cargo (treadway).....	14
Average per vehicle for a mixed column of various types..	10

¹ For time length of foot elements in column see *c* below. Factors include normal distances between units.

² For road spaces and time lengths for motor elements at various rates of march see paragraph 55f.

³ Allows 1 to 2 yards between vehicles. See chapter 5 for actual lengths of vehicles, towed weapons, and trailers.

(3) *Use of values.*

- (a) A battalion of infantry with 800 men marching in column of threes: 800×1.3 (see (1) above) = 1,040 yards road space.

(b) A mixed motor column consisting of—

	<i>Yards</i>
20 trucks, $\frac{1}{4}$ -ton, with weapons in tow at 8 yards each.....	160
25 trucks, $\frac{3}{4}$ -ton, with trailer in tow at 10 yards each.....	250
75 trucks, $1\frac{1}{2}$ -ton, at 9 yards each.....	675
40 trucks, $2\frac{1}{2}$ -ton, with trailers in tow at 16 yards each.....	640
40 tanks at 8 yards each.....	320

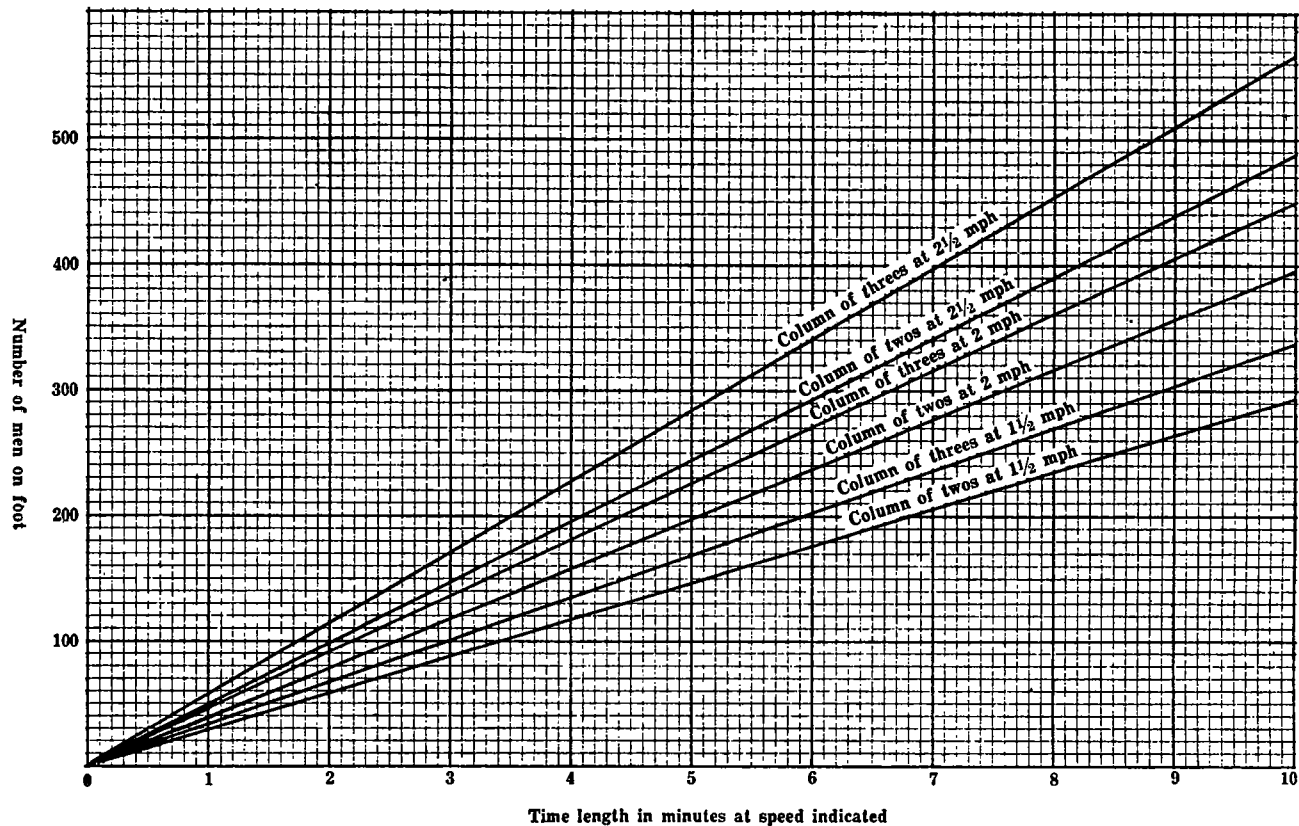
 200 Total .

Total road space at halt..... 2, 045

Alternate solution (see (2) above):

200 vehicles (mixed) at 10 yards each..... 2, 000

c. *Average Time Lengths of Columns on Foot.*



*d. Rates and Lengths of Marches, Foot, Animal and Motor Elements.**

(1) The following rates and lengths of marches are based upon modern vehicles, trained personnel, and favorable conditions of roads and weather:

1	2	3	4	5	6	7
	Unit	Rates of march (mph) ¹			Lengths of march on roads (miles per day average) ²	Remarks
		On roads ³		Cross country		
		Day	Night	Day	Night	

INFANTRY ⁴

2	Foot troops.....	2½	2.....	1½	1	12-15 for a division, 15-20 for smaller units.	Length of march increased with well-seasoned troops marching on good roads in favorable weather when required by the tactical situations. ⁵
---	------------------	----	--------	----	---	--	--

ARTILLERY

3	Pack (less motor elements).	3½	3.....	3	2	20	
4	Truck-drawn, light or medium.	25	25 (lights)..... 10 (no lights).	8	5	175	
5	Tractor-drawn medium (M5).	21	15 (lights)..... 10 (no lights).	10	4 (lights) (1½ no lights).	150	
6	Truck-drawn, heavy...	18	18 (lights)..... 10 (no lights).	6	4	135	
7	Tractor-drawn, heavy...	15	15 (lights)..... 10 (no lights).	6	4 (lights) (1½ no lights).	135	
8	Antiaircraft artillery, truck-drawn.	20	20 (lights)..... 10 (no lights).	8	5	175	
9	Antiaircraft artillery, self-propelled.	20	20 (lights)..... 10 (no lights).	12	5	175	

See footnotes at end of table.

*The rate of march of a column composed of elements with different rates of march is regulated by that of the slowest element.

1	2	3	4	5	6	7
Unit	Rates of march (mph) ¹				Lengths of march on roads (miles per day average) ³	Remarks
	On roads ²		Cross country			
	Day	Night	Day	Night		

ARMORED

10	Tanks, light and armored personnel carriers.	20	(Lights)..... 10 (no lights).	12	5	150	Armored division moves at rate of march of medium tanks.
11	Tanks, med-heavy.....	15	15 (lights)..... 10 (no lights).	5	3	100	

MISCELLANEOUS

12	Pack train.....	3½	3.....	3	2	20	Single vehicles or small columns of less than 50 vehicles.
13	Infantry division, motorized.	15	15 (lights)..... 10 (no lights).			150	
14	Trucks and ambulances.	25	25 (lights)..... 10 (no lights).			150	
15	Cars, passenger.....	35	35 (lights)..... 10 (no lights).			250	

¹ Rate of march is average speed over a period of time, including short, periodic halts.
² Rates of march for motorized elements listed in columns 2 and 3 are possible only on improved roads.
³ Greater distances than those given in column 6 may be covered under forced march conditions.
⁴ For movement over mountainous terrain, an additional allowance of 1 hour should be made for each 1,000 feet of climb.

(2) *Marches in snow and extreme cold.*
(a) Foot troops marching in snow without snowshoes or skis will have their mobility decreased. The decrease of mobility will depend on several factors, among which are depth and nature of the snow. Normally, snow of a depth of 24 inches or more will prohibit marching unless skis or snowshoes are used. For specially equipped and adequately trained troops, the following rates of march are practicable:

Snowshoes.. 1½ to 2½ miles per hour.
Skis..... 1½ to 3½ miles per hour.

Small bodies of well-trained troops are capable of moving 40 miles a day on skis, under favorable conditions.

(b) *Dog teams.* Average dog teams of seven dogs hauling a 500-pound load are capable of moving 5 to 7 miles per hour for 6 to 7 hours daily, an average day's march being approximately 30 miles.

(c) *Motor movement (wheel) in snow.*

Depth snow (in.)

Measures required for movement

3-----	None.
6-----	Rear chains.
6-18-----	Chains all around; and special traction devices on leading vehicles (to break the trail).
18 and over-----	Snow plow required.

e. *Forced Marches of Foot Elements.*

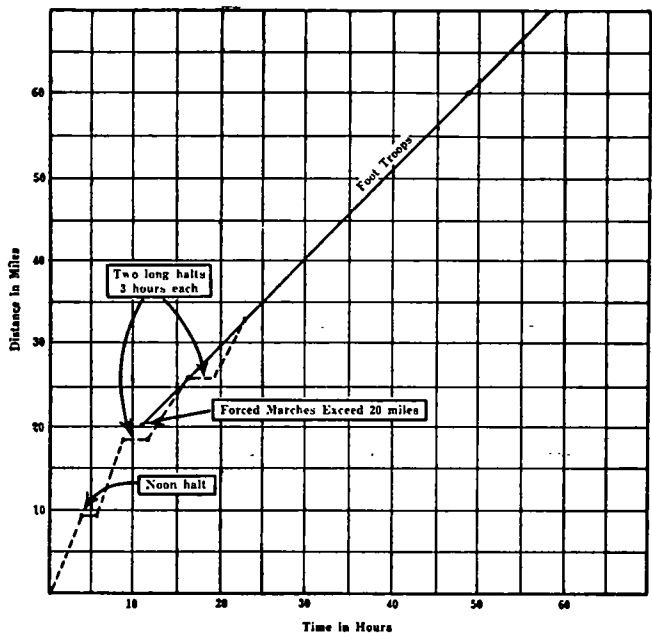
(1) *General.* Seasoned troops when well rested at the beginning of the march, with good weather and good roads, are capable of reaching their destination physically fit to engage in combat after making forced marches (marches in excess of 20 miles) as indicated in the graph in (3) below.

(2) *Examples of use of graph.* Assume it is desired to start a column of foot troops at daylight and accomplish a march of 33 miles. The graph shows that this distance will require a minimum elapsed time of 22½ hours. Such a march might be divided as follows:

	Hours
Total elapsed time-----	22½
First stage, 18 miles. At 2½ miles per hour (daylight, on roads) and allowing for a noon halt of about 1½ hours, the time required for this stage is-----	9
Second stage, 15 miles. At 2 miles per hour (night, on roads) the time required for this stage is-----	7½
Total for both stages-----	16½
Available for a long rest halt between stages-----	6

The forced march could be divided into three or more stages instead of two, in which case two or more long rest halts totaling 6 hours could be scheduled (illustrated by dotted line on graph).

- (3) *Forced march graph.* The most important point to keep in mind when planning forced marches is that the *rate of march is not increased*. The increase is in the number of marching hours per day.



55. Movement by Motor

a. *Vehicle Capacities.*

- (1) *Truck capacities for personnel.* The capacity of motor transportation for movement of foot troops depends upon the rated capacity of the transportation employed, the type of body on the vehicles, the method of carrying personnel, and the distance personnel are to be moved. Normal capacities for trucks carrying personnel with rifles, packs, and extra ammunition, with no additional cargo, are—

	Men
Truck, ¼-ton (excluding driver)	3
Truck, ¾-ton (excluding driver)	9
Truck, 1½-ton (excluding driver)	15
Truck, 2½-ton (excluding driver)	25

Note. When 2½-ton engineer dump trucks, or 2½-ton short wheelbase artillery trucks carry the loads shown above, some personnel will be required to stand.

- (2) *Truck capacities for horses or mules:*

Truck, 1½-ton (exceptional)	2 plus 2 men with equipment.
Truck, 2½-ton, cargo	4 plus 4 men with equipment.

b. *Tabulating Number of Trucks Required for Movement by Motor Transport.* The following format may be used to tabulate the approximate number of trucks required to move foot elements with individual equipment.

	1	2	3	4	5	6
	Unit	Actual strength	Transported in organic motors	Strengths for which transportation must be furnished	Number of trucks required	
					1½-ton	2½-ton
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						

c. *Traffic Flow of Motor Columns.* By traffic flow of motor columns is meant the total number of vehicles passing a given point in a certain time. Traffic flow usually is expressed in vehicles per hour and can be determined for any route by this formula—

Traffic flow in vehicles per hour=
Density in vehicles per mile × speed in miles per hour × *F*.

F (a variable) depends upon the standing operating procedure time intervals between march units and serials applicable in the area and upon the overall state of proficiency of units operating in the area in motor movement and traffic control. For adaptation to a specific area under field conditions, it is necessary that time and space studies be conducted continuously in order to arrive at a suitable factor.

This study may result in a basic factor to which allowance for time gap between march units and serials must be added, or a basic factor including allowance for time gap between march units and serials.

d. Density of Motor Columns.

- (1) The density of a motor column is defined as the number of vehicles per mile of road space occupied by vehicles. Motor columns may be classified as either close column, open column, or infiltration.
 - (a) *Close column.* In close column, vehicles are closed to safe driving distance behind the preceding vehicle. Usually a fixed speedometer multiplier (SM)* is specified (such as 2, 2.35, 2.5, 3, etc.) to accomplish a safe-driving intervehicular distance at all speeds.
 - (b) *Open column.* In open column, distances between vehicles are increased to accomplish greater dispersion. Usually a fixed density is specified (such as 10, 15, or 20 vehicles per mile) but open column conditions may be obtained by designating a fixed speedometer multiplier high enough to insure the desired intervehicular lead at the lowest speed expected.
 - (c) *Infiltration.* In infiltration, vehicles are dispatched at irregular intervals with a fixed density (such as 3, 4, 5, or 6 vehicles per mile).
- (2) To determine the density of a motor column, when the speed and speedometer multiplier are known, use the following formula:

$$\text{Density} = \frac{1,760 \text{ (yards per mile)}}{\text{Speed (mph)} \times \text{SM}}$$

for example: with a speed of 20 mph and a SM of 2, vehicle density equals—

$$\frac{1,760}{20 \times 2} = 44 \text{ vehicles per mile.}$$

e. Average Road Spaces and Time Lengths of Motor Columns at Various Speeds.

- (1) *Road space.* The road space occupied by a motor column may be obtained when the number of motor vehicles in the column (disregarding trailers and towed weapons), the

*For logistical purposes, speedometer multiplier (SM) is any number by which speed in miles per hour is multiplied to determine intervehicular lead in yards. *Example:* with a SM of 2, the intervehicular lead of two successive vehicles (measured from head to head) at a speed of 10 mph is $2 \times 10 = 20$ yards; at a speed of 25 mph, it is $2 \times 25 = 50$ yards.

average density (number of vehicles per mile), and the total of the time gaps between subordinate units is known.

$$\text{Road space (miles)} = \frac{\text{Number of motor vehicles}}{\text{Density (vehicles per mile)}} + \frac{\text{Time gaps (min)} \times \text{speed (mph)}}{60}$$

An approximation of road space may be determined by the following:

$$\begin{aligned} \text{Road space (miles)} &= \text{No. of vehicles} \div 75 \text{ (less than 50 vehicles in close column).} \\ &= \text{No. of vehicles} \div 20 \text{ (50 or more vehicles in close column).} \\ &= \text{No. of vehicles} \times .02 \text{ (less than 50 vehicles in open column).} \\ &= \text{No. of vehicles} \times .06 \text{ (50 or more vehicles in open column).} \\ &= \text{No. of vehicles} \div 3 \text{ (any number of vehicles marching by infiltration).} \end{aligned}$$

In close column a 15 minute time interval occupies 2.5 miles of road space and in open column 3.75 miles of road space. The chart in *f* below shows the average road space under ideal conditions and does not include allowances for intervals between march units. Actual road space may vary somewhat depending upon conditions.

To use chart:

Determine the number of motor vehicles in column, disregarding trailers or towed weapons.

Locate the figure on vertical scale at left of chart, marked "number of vehicles."

Locate the figure showing average density under which the movement will be made, on the vertical scale marked "Density, veh/mi."

Connect these two points with a straightedge. Read the figure at the point of intersection of the straightedge with the vertical scale marked "Road space, miles."

This will be the road space, in miles, occupied by the column under the given conditions.

- (2) *Time length.* The time length of a column is the space of time between the instant the head of a column passes a given point and the tail of the column passes the same point. The time length may be determined by the following formula:

$$\text{Time length (min)} = \frac{\text{Road space (miles)} \times 60}{\text{Speed (mph)}}$$

An approximation of time length may be determined by the following:

- Time length (min) = No. of vehicles $\times$ 0.08 (less than 50 vehicles in close column).
 = No. of vehicles $\times$ 0.12 (50 or more vehicles in close column).
 = No. of vehicles $\times$ 0.20 (less than 50 vehicles in open column).
 = No. of vehicles $\times$ 0.24 (50 or more vehicles in open column).
 = No. of vehicles $\times$ $\frac{1}{3}$ any number of vehicles marching by infiltration.

f. Road Space and Time Length Chart. The following chart shows average time lengths under ideal conditions and does *not* include allowances for time intervals between march units. Actual time length may vary somewhat depending upon conditions.

To use chart:

Obtain road space as directed in *e*(1) above.

Locate the figure representing the speed in miles per hour on the vertical scale marked, "Speed, mi/hr."

Connect these two points with a straightedge.

Read the figure at the intersection of the straightedge with the vertical scale marked "Time length."

This figure is the time length of the column under the conditions given.

Number
of
vehicles

Road
space

Speed

Density

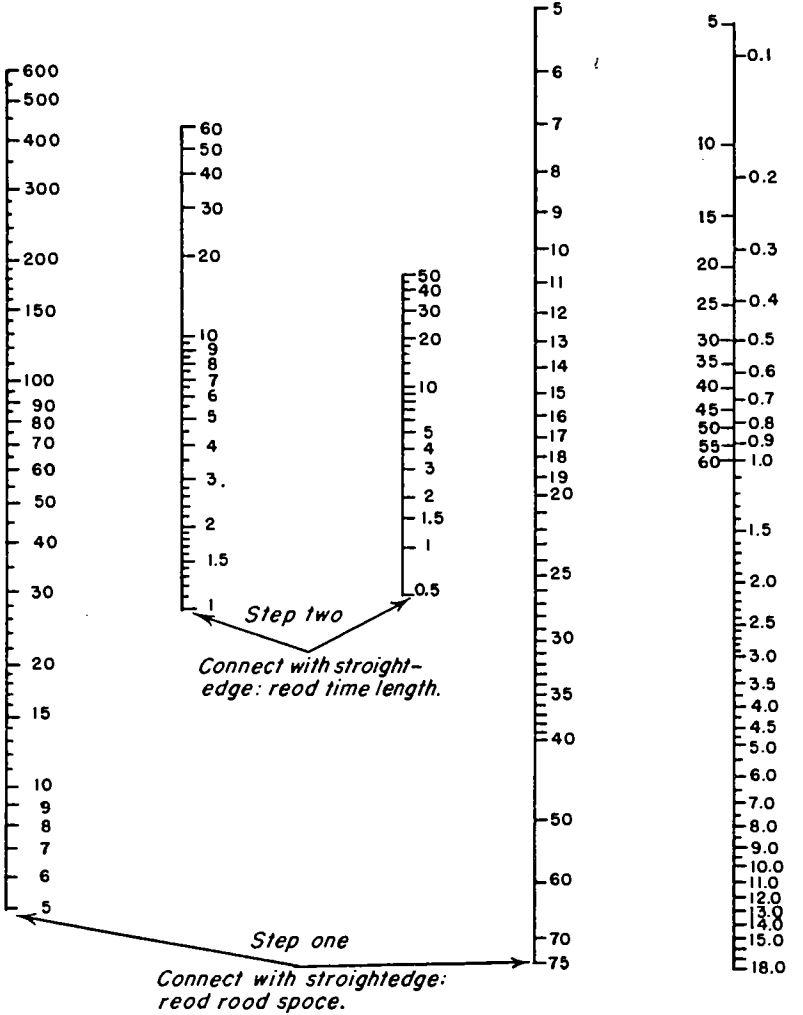
Time
length

(miles)

(mph)

(Vehicles
per mile)

Minutes Hours



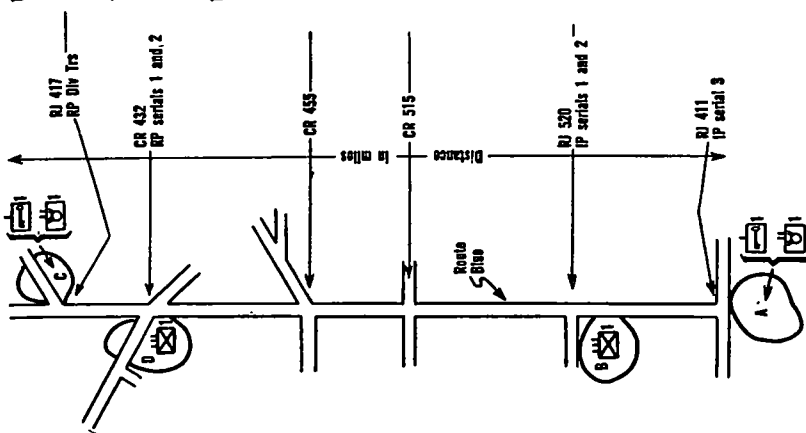
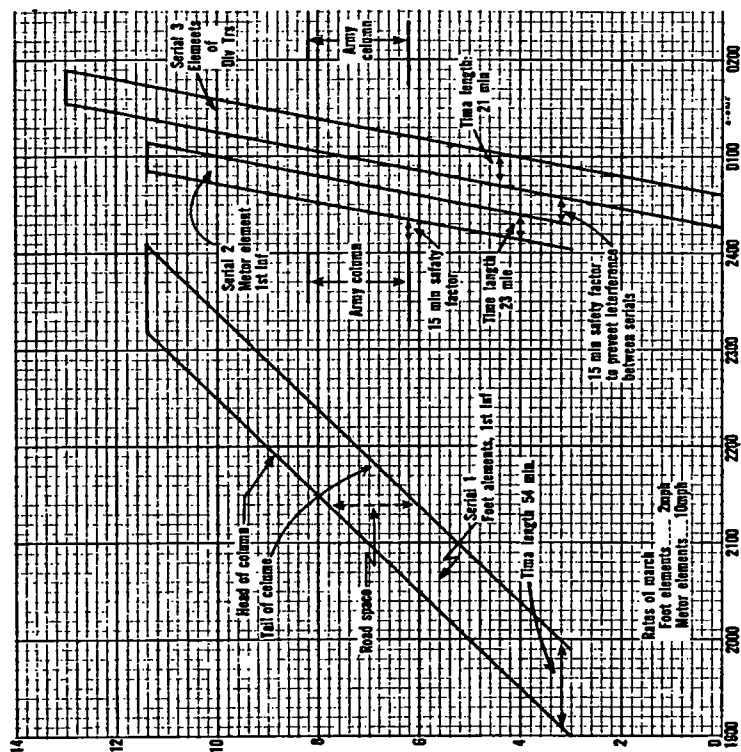
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g. March Graphs and March Tables.

- (1) The operation order for a march may be accompanied by a march table, particularly when the details of the march are not subject to change and can be foreseen.
- (2) A march graph is the simplest method of obtaining data required for a march table or order. It shows the approximate location at any hour of the head or tail of each serial, providing the march proceeds as scheduled. The vertical scale to the left, with point of origin at the bottom, serves as a distance scale in miles and should show the relative locations, along the route, of critical points where coordination of the movement is required. The horizontal scale provides a time scale in hours, beginning at the left with the earliest hour at which the first serial may start the march.
- (3) A serial is represented graphically by drawing a line to represent the movement of the head of the serial and a line to represent the movement of the tail of the serial. The lines are parallel and are drawn with a slope that represents the rate of march. (At 10 miles per hr., the slope equals 10 miles on the vertical to 1 hr. on the horizontal scale.)

h. Example of March Graph, and March Table. See graph.

- (1) The 1st Infantry Division commander has directed that the 1st Ordnance Battalion, 1st Quartermaster Company, and the 1st Infantry, move under cover of darkness from their present bivouacs, areas A and B, to areas C and D.
- (2) Vehicles of the three infantry battalions will move during the night 26-27 October.
- (3) Foot troops of regiment, motor vehicles of regiment (less battalion vehicles), and vehicles of quartermaster and ordnance companies will move during the night 27-28 October. (Movement to begin at 271900 Oct. and be completed by 280430 Oct.)



FOR OFFICIAL USE ONLY

Annex 1 (March Table) to Opn O 2
Map: Operation map

March Table

1st Inf Div
KETOKU (1210-3365)
271500 Oct 19----

1	2	3	4	5	6	7	8	9	10	11	12
Serial No.	Organization and commander	Present location	Route	Location by 0330 28 Oct	March			Control of movement			Remarks
					Rate (mph)	Type	Time length (min)	Location of critical points	Earliest arrival time	Latest clearance time	
1	Col Able, 1st Inf, Comdg..... Foot troops 1st Inf. 2,109 men.	Area B..	Blue....	Area D..	2	Column of twos...	54	RJ 520 (IP)..... CR 515..... CR 455..... CR 432 (RP).....	1900 2036 2136 2312	1954 2130 2230 0006	
2	Lt Col Baker, 1st Inf, Comdg..... Motor elements 1st Inf (-)..... 142 vehicles.	Area B..	Blue....	Area D..	10	Close column.....	18	RJ 520 (IP)..... CR 515..... CR 455..... CR 432 (RP).....	0001 0021 0033 0052	0019 0039 0051 0110	
3	Capt. Cain, 1st Ord Bn, Comdg.... Portion of Div Trs: 1st Ord Bn..... 1st QM Co..... 169 vehicles.	Area A..	Blue....	Area C..	10	Close column.....	21	RJ 411 (IP)..... RJ 520..... CR 515..... CR 455..... CR 432..... RJ 417 (RP).....	0016 0034 0054 0106 0125 0134	0037 0055 0115 0127 0146 0155	

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Columns 2, 3 and 9: Based on periodic reports of subordinate units.

Column 6: Group which normally precedes main body to new area for reception of troops.

Column 7: Vehicles not required for immediate support, such as kitchen, baggage motor maintenance, are designated field trains.

Column 10: Number of men on foot⁽¹⁾⁽²⁾ (Col. 9) $\times 1.3 = \text{yd} \div 1,760 = \text{miles}$.

Column 11: Number of men on foot (Col. 9) $\times 1.5 = \text{yd} \div 1,760 = \text{miles}$.

Columns 12 and 13; 24 and 25: No. of vehicles $\times$ factor (par. 55e(1)) + time intervals in miles = miles.

Columns 14, 15, and 16: $\frac{\text{road space (Col. 10)} \times 60}{\text{Speed (mph)}} = \text{minutes}$.

Columns 17, 18, and 19: $\frac{\text{road space (Col. 11)} \times 60}{\text{Speed (mph)}} = \text{minutes}$.

Columns 20, 21, 26 and 27: No. of vehicles $\times$ factor (par. 55e(2)) + ³ time intervals in minutes = minutes.

Column 22: Number of men on foot (Col. 9) $\div 25$ except to ensure tactical integrity.

Line 43: Combat team is composed of: Inf Regt; FA Bn, 105-mm; Engr C Co; AAA AW Btry SP; Det, Ord Bn; and Det Sig Co.

Line 44: Division troops are composed of: Div Hq & Hq Co (-); Sig Co (-); Div Arty (-); MP Co (-); Tk Bn; Engr C Bn (-); Med Bn; and Recon Co (-).

Line 45: Division trains are composed of: Rr Ech Div Hq & Hq Co; Det Sig Co; Det MP Co; QM Co; Ord Bn (-); Repl Co; and Fld Tns.

For further information of breakdown, see following pages.

¹ In computing men on foot, first consideration is given to the prescribed loads of the vehicles. After this prescribed load is placed on vehicles, the remaining capacity is loaded with personnel.

² The 24 men who normally walk in a Bn Med Plat are distributed as follows:

4 aid men with ea Rifle Co.....	12
Aid men with Hv Wpn Co.....	3
Bn Hq & Hq Co.....	9

24

³ Time intervals within a serial average 1 minute per 25 vehicles (not considered when serial consists of less than 50 vehicles). Time interval between serials is 15 minutes.

i. Table of Road Spaces and Time Lengths—Infantry Division.*
(1) Example:

Line	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	Line
	UNIT	Actual strength								Road space (miles)				Time length (minutes)								Additional Veh to carry foot Trp (Colm 9) (2 1/4-T Trk)	Total Veh in march Colm when unit moves by Trk (Colm 8 + Colm 22)	Road space (miles)		Time length (minutes)		
		Off and EM	Organic Veh	Recon party	Dispersed along route	Veh in advance party	Veh in field trains	Veh in march Colm	Men on foot	Men on foot halted or moving		Vehicles in march Colm (Colm 8)		Men on foot						Veh in march Colm (Colm 8)				Vehicles of units Mtz (Colm 23)		Vehicles of units Mtz (Colm 23)		
										Colm of threes	Colm of twos	Close Colm 75 Veh/ml 10 mph	Open Colm 20 Veh/ml 15 mph	Colm of threes			Colm of twos			Close Colm 75 Veh/ml 10 mph	Open Colm 20 Veh/ml 15 mph			Close Colm 75 Veh/ml 10 mph	Open Colm 20 Veh/ml 15 mph	Close Colm 75 Veh/ml 10 mph	Open Colm 20 Veh/ml 15 mph	
														1 1/4 mph	2 mph	2 1/4 mph	1 1/4 mph	2 mph	2 1/4 mph									
1																												
2	Inf Div.....	17,454	2,679	38	39	92	232	2,510	5,748	4.2	4.9	60.2	165.6	168	126	101	194	147	118	361	662	270	2,780	65.6	181.8	394	728	2
3	3 Inf. Regt (ea).....	3,521	370			10	44	316	1,916	1.4	1.6	6.3	19.0	56	42	34	64	48	39	38	76	90	406	8.1	24.4	49	98	3
4	Hq and Hq Co.....	261	50			2	1	47	31			.6	2.4							4	10	2	49	.7	2.5	4	10	4
5	Svc Co.....	176	61			2	34	25	31			.3	1.3							2	5	1	26	.4	1.4	3	6	5
6	Hv Mort Co.....	173	30				2	28				.4	1.4							3	6		28	.4	1.4	3	6	6
7	Tk Co.....	143	32				3	29				.4	1.5							3	6		29	.4	1.5	3	6	7
8	Med Co.....	197	23				4	19	72			.3	1.0							2	4		19	.3	1.1	2	5	8
9	3 Inf Bn (ea).....	857	58			2		56	594	.4	.5	1.1	2.8	16	12	10	20	15	12	7	14	29	85	1.7	5.1	11	21	9
10	Hq and Hq Co.....	110	17			2		15	37			.2	.8							2	3	2	17	.3	.9	2	4	10
11	Hv Wpn Co.....	159	26					26	47			.3	1.3							3	6	3	29	.4	1.5	3	7	11
12	3 rifle Co (ea).....	196	5					5	170	.1	.1	.1	.3	4	3	3	4	3	3	1	1	8	13	.3	.8	1	3	12
13	Div Arty.....	3,362	726			26	54	646				13.0	38.8	78						78	156		646	13.0	38.8	78	156	13
14	3 FA Bn 105-mm How (ea).....	620	138			6	10	122				2.4	7.3							15	30		122	2.4	7.4	15	30	14
15	3 FA Btry (ea).....	129	24			1	1	22				.3	1.1							2	5		22	.3	1.1	2	5	15
16	FA Bn 155-mm How.....	605	123			6	8	109				2.2	6.5							14	27		109	2.2	6.6	14	27	16
17	3 FA Btry (ea).....	132	22			1	1	20				.3	1.0							2	4		20	.3	1.0	2	4	17
18	AAA AW Bn (SP).....	685	134			2	16	116				2.3	7.0							14	28		116	2.3	7.0	14	28	18
19	4 AW Btry (ea).....	136	26				2	24				.3	1.2							2	5		24	.3	1.2	2	5	19
20	Div Hq & Hq Co, Band, and Med Det.....	421	55			7		48				.7	2.4							4	10		48	.6	2.4	4	10	20
21	Fwd Ech Div CP.....	170	42			5		37				.5	1.9							3	8		37	.5	1.9	3	8	21
22	Rr Ech Div CP.....	251	13			2		11				.2	.6							1	3		11	.1	.6	1	3	22
23	Engr C Bn.....	843	170	2		1	6	161				3.2	9.7							20	39		161	3.2	9.7	20	39	23
24	4 Engr C Co (ea).....	156	24				1	23				.3	1.2							2	5		23	.3	1.2	2	5	24
25	Med Bn.....	312	78			1	2	75				1.5	4.5							9	18		75	1.5	4.5	9	18	25
26	Amh Co.....	84	37				1	36				.5	1.8							3	8		36	.5	1.8	3	8	26
27	Clr Co.....	134	20				1	19				.3	1.0							2	4		19	.3	1.0	2	4	27
28	MP Co.....	175	55		39	7		9				.1	.5							1	2		9	.1	.5	1	2	28
29	Det with Div Tns.....	12	3					3												1	1		3		.2	1	1	29
30	3 MP Tfc Plat (ea).....	34	13		13																							30
31	Ord Bn.....	327	104			1		103				2.1	6.2							13	25		103	2.1	6.2	13	25	31
32	Ord Co Fwd.....	163	50			1		49				.7	2.5							4	10		49	.7	2.5	4	10	32
33	Ord Co Rr.....	133	47					47				.6	2.4							4	10		47	.6	2.4	4	10	33
34	Det with ea CT.....	49	15					15				.2	.8							2	3		15	.2	.8	2	3	34
35	QM Co.....	219	83			1		82				1.6	4.9							10	20		82	1.6	4.9	10	20	35
36	Recon Co.....	160	39	36			3																					36
37	Repl Co.....	37	4			1		3				.2								1	1		3		.2	1	1	37
38	Slg Co.....	362	88			15	1	72				1.4	4.3							9	18		72	1.4	4.3	9	18	38
39	Det with ea CT.....	14	3					3				.2								1	1		3		.2	1	1	39
40	Det with Rr Ech CP.....	34	6			2		4				.2								1	1		4		.2	1	1	40
41	Tk Bn.....	673	167			2	34	131				2.6	7.9							16	32		131	2.6	7.9	16	32	41
42	3 Tk Co (ea).....	111	23				3	20				.3	1.0							2	4		20	.3	1.0	2	4	42
43	Combat team (ea).....	4,496	576			16	57	503	1,916	1.4	1.6	10.1	30.2	56	42	34	64	48	39	61	121	90	593	11.8	35.6	72	143	43
44	Div Trp.....	3,233	763	38	39	37	61	608				12.2	36.5							73	146		608	12.2	36.5	73	146	44
45	Div Tn.....	733	168			7	232	393				7.9	23.6							48	95		393	7.9	23.6	48	95	45

*Based on TOE current as of 30 November 1964.



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(2) *March organization for use with table of road spaces and time lengths.*

	1	2	3	4	5	6	7	8	9	10
1	Unit	Precedes march column	Pre- cedes march column	Dis- persed along route	Serial 1	Serial 2	Serial 3	Serial 4	Serial 5	Total
		Advance party	Rcn party		Combat team 1	Combat team 2	Combat team 3	Div Trs	Div Tns	Organic vehicles
2	Combat Teams.	(3 × 16) 48	-----	-----	503	503	503	-----	(Fld Tns) 3×57 =171 (Fld Tns)	48+3(503)+ 171=1, 728
3	Div Trps---	37	38	39	-----	-----	-----	608	61	783
4	Div Tns---	7	-----	-----	-----	-----	-----	-----	161 (Fld Tns)	168
5	Rcn Co.---	-----	(36)	-----	-----	-----	-----	-----	(3)	(*39)
6	Engr Rcn Sec.	-----	(2)	-----	-----	-----	-----	-----	-----	* (2)
7	MP Traf Plats---	-----	-----	(3×13 =39)	-----	-----	-----	-----	-----	*(39)
8	Totals-----	92	38	39	503	503	503	608	393	2, 679
Not in march column 169					Total in march column 2,510					*Incl in total of Div Troops.
Total organic vehicles 2,679										

j. Average Time Factors—Infantry Division.

- (1) These data pertain to G3 time factors considered after a division receives a movement order. They give the times required by the command for—
 - (a) Making preparations before the leading vehicle can arrive at the IP (initial point).
 - (b) Completing the motor march and making preparations to launch a coordinated attack.
- (2) The preparations before the leading vehicle can arrive at the IP include transmission of orders by division; assembling trucks; spotting trucks; map reconnaissance of routes, de-trucking areas, and assembly areas; issue of extra ammunition; briefing of troops; and other normal preparations for an anticipated movement. This preparation pertains to the *first* trip, whether the division is completely motorized by attached transportation and moves in one trip, or whether the division moves by organic transportation in two or more

trips (echelon). The earliest time in which the leading vehicle can pass the IP after receipt of the order by the division commander is—

- | | <i>Hours</i> |
|---|--------------|
| (a) If the order was received in daylight for a daylight march, for example, received at 1000, leading vehicle can cross IP at 1130----- | 1½ |
| (b) If the order was received at night for a night march, for example, received at 2200, leading vehicle can cross IP at 2400--- | 2 |
| (c) If the order was received in daylight for a night march, for example, received at 1100, leading vehicle can cross IP 1 hour after EENT-----1 hr after EENT (For EENT see par. 46.) | |
| (d) If the order was received at night for a daylight march, and more than 2 hours prior to BMNT, for example, received at 0200, leading vehicle can cross IP at BMNT----- (For BMNT, see par. 46). | |
- (If the order was received less than 2 hours prior to BMNT, the time is the time the order was received plus 2 hours.)

Note. To determine corresponding time factors for a foot march instead of a motor march, use ½ hour less in (a), (b), and (c) above.

- (3) The factors considered in computing time to complete a march and to make preparations for launching a coordinated attack are dependent upon whether the march is made by echelon or completed in one trip. The following time factors in (a), (b), (c), and (d) below are applicable only when the march is made by echelon. The time factors shown in (e), (f), (g), (h), and (i) below apply to any motor move and outline the procedure used in determining the earliest time at which an infantry division can launch a coordinated attack. These factors are based upon the assumption that the infantry division can launch a coordinated attack when two assault battalions of each assault regiment are in position behind the line of departure. Since the closing of these assault battalions requires more time than the preparation and movement of the other attack forces, supporting units such as artillery, reserves, etc., will be in position prior to closing of the assault battalions on the line of departure. The factors are further based upon the assumption that these assault battalions will be the leading elements of the march serials.

	<i>Day</i>	<i>Night</i>
(a) Dump basic loads-----	15 min.	30 min.
(b) Load basic loads-----	30 min.	60 min.
(c) Reassemble trucks for each trip made in convoy-----	20 min.	40 min.
(d) Entruck personnel-----	10 min.	20 min.

- (e) Complete the motor march from the old area to the new area..... See above.

Note. If the release point (RP) is approximately 3 miles from the detrucking point (DP), which is the normal case if the RP and the new assembly area are properly selected, this time factor will be the time to complete the move from IP to RP. Any consideration of time consumed in moving by motor from the RP to the DP in the new area is included in the time factors given in (g) below. If the distance is over 3 miles from RP to DP, the time to traverse this distance must be added to the time required to complete the move from the IP to the RP before considering the time factor for detrucking troops in (f) below.

- | | <i>Day</i> | <i>Night</i> |
|--|-----------------------|--------------|
| (f) Detruck, reform foot troops..... | 5 min. | 10 min. |
| (g) Organization and movement in the new assembly area prior to troops reaching the foot IPs for the foot march to the line of departure. (This includes movement from the RP as outlined in (e) above as well as time to issue any additional rations or ammunition carried in each truck transporting troops.)..... | 30 min. | 60 min. |
| (h) Time to move from foot IPs in the new area to line of departure. (Time distance of foot march.)..... | See paragraph 54d(1). | |
| (i) Time for final preparation after the leading man reaches the line of departure and prior to launching a coordinated attack. (This factor includes time to close foot troops behind the line of departure, time to reconnoiter, issue orders in subordinate units, and emplace and register infantry weapons where necessary.)..... | 60 min. | 90 min. |

Table of Road Spaces and Time Lengths—Armored Division

	1	2	3	4	5	6	7	8	9	10	11	12
		Actual strength							Road space ² (miles)		Time length ³ (minutes)	
1	Unit	Off and EM	Organic Veh ²	Recon party	Dispersed along route	Veh in Adv party	Veh in Fld Tn	Veh in march Colm	Veh in march Colm (Colm 8)		Veh in march Colm (Colm 8)	
									Close Colm 75 Veh/mi 10 mph	Open Colm 20 Veh/mi 15 mph	Close Colm 75 Veh/mi 10 mph	Open Colm 20 Veh/mi 15 mph
2	Armd Div.....	14,650	3,332	200	39	96	706	2,291	46	137.5	275	550
3	Div Trp.....	894	197	-----	39	31	15	112	2.2	6.7	14	27
4	Hq & Hq Co, Armd Div ¹	357	52	-----	-----	7	3	42	0.6	2.1	3	8
5	Armd Sig Co.....	362	95	-----	-----	17	12	66	1.3	4	8	16
6	MP Co.....	175	50	-----	39	7	-----	4	0.1	0.2	1	1
7	3 MP Tfc Plat (each).....	34	13	-----	13	-----	-----	-----	-----	-----	-----	-----
8	3 Hq & Hq Co, CC and Res Comd (ea).....	105	30	-----	-----	2	1	27	0.4	1.4	3	6
9	CC ⁴	3,121	659	37	-----	13	40	569	11.4	34.6	69	137
10	Hq & Hq Co, CC.....	105	30	-----	-----	2	1	27	0.4	1.4	3	6
11	Tk Bn (90-mm Gun) ¹	713	176	-----	-----	2	11	163	3.3	9.8	20	40
12	Tk Co (120-mm Gun).....	143	32	-----	-----	-----	1	31	0.4	1.6	3	7
13	Armd Inf Bn ¹	978	153	-----	-----	2	13	138	2.8	8.3	17	34
14	Armd FA Bn (105-mm How, SP).....	618	148	-----	-----	6	12	130	2.6	7.8	16	32
15	AAA Btry (AW) (SP).....	136	26	-----	-----	1	1	24	0.3	1.2	2	5
16	Armd Engr Co.....	152	27	-----	-----	-----	1	26	0.3	1.3	3	6
17	Recon Co.....	153	37	37	-----	-----	-----	-----	-----	-----	-----	-----
18	Armd Med Co.....	108	24	-----	-----	-----	-----	24	0.3	1.2	2	5
19	Armd Ord Contact Party.....	15	6	-----	-----	-----	-----	6	0.1	0.3	1	2

20	3 Tk Bn (90-mm Gun) ¹ (ea).....	713	176			2	11	163	3.3	9.8	20	40
21	Hq & H & S Co.....	248	84			2	7	75	1.5	4.5	9	18
22	4 Tk Co (90-mm Gun) (ea).....	111	23				1	22	0.3	1.1	2	5
23	Tk Bn (120-mm Gun) ¹	691	178			2	11	165	3.3	9.9	20	40
24	Hq & H & S Co.....	243	82			2	8	72	1.4	4.3	9	18
25	3 Tk Co (120-mm Gun) (ea).....	143	32				1	31	0.4	1.6	3	7
26	4 Armd Inf Bn ¹ (ea).....	978	153			2	13	138	2.8	8.3	17	34
27	Hq & H & S Co.....	199	61			2	9	50	1.0	2.5	4	10
28	4 Rifle Co (ea).....	186	23				1	22	0.3	1.1	2	5
29	Div Arty ¹	3,390	779			31	63	685	13.7	41.1	83	165
30	Hq & Hq Btry.....	161	56			2	4	50	1.0	2.5	4	10
31	3 Armd FA Bn (105-mm How, SP) (ea).....	618	148			6	12	130	2.6	7.8	17	32
32	Hq & Hq Btry.....	159	38			2	3	33	0.4	1.7	3	7
33	3 Armd FA Btry (ea).....	121	26			1	1	24	0.3	1.2	2	5
34	Svc Btry.....	96	32			1	6	25	0.3	1.3	2	5
35	Armd FA Bn (155-mm How, SP).....	626	139			6	12	121	2.4	7.3	15	30
36	Hq & Hq Btry.....	128	29			2	3	24	0.3	1.2	2	5
37	3 Armd FA Btry (ea).....	134	26			1	1	24	0.3	1.2	2	5
38	Svc Btry.....	96	32			1	6	25	0.3	1.3	2	5
39	AAA Bn (AW) (SP).....	692	140			5	11	124	2.5	7.4	15	30
40	Hq & Hq Btry.....	148	36			1	7	28	0.4	1.4	3	6
41	4 AAA Btry (AW) (SP) (ea).....	136	26			1	1	24	0.3	1.2	2	5
42	Armd Engr Bn ¹	916	227	4		1	15	207	4.1	12.4	25	50
43	Hq & H & S Co.....	168	58	4		1	11	42	0.6	2.1	4	9
44	Brg Co.....	114	61					61	1.2	3.7	8	15
45	2 Brg Plat (ea).....	38	25					25	0.3	1.3	2	5
46	4 Engr Co (ea).....	152	27				1	26	0.3	1.3	3	6
47	Recon Bn ^{1,4}	783	196	196					3.9	11.8	24	48
48	Hq & H & S Co ¹	144	48	48					0.8	2.4	4	10
49	4 Recon Co (ea) ¹	153	37	37					0.7	1.8	3	8
50	Armd Div Tn ¹	1,610	525			11	514					
51	Hq & Hq Co.....	81	38			4	34					
52	Armd Div Band.....	43										

See footnotes at end of table.

Table of Road Spaces and Time Lengths—Armored Division—Continued

1	2	3	4	5	6	7	8	9	10	11	12
	Actual strength							Road space ² (miles)		Time length ³ (minutes)	
Unit	Off and EM	Organic Veh ³	Recon party	Dispersed along route	Veh in Adv party	Veh in Fld Tn	Veh in march Colm	Veh in march Colm (Colm 8)		Veh in march Colm (Colm 8)	
								Close Colm 75 Veh/mi 10 mpb	Open Colm 20 Veh/mi 15 mph	Close Colm 75 Veh/mi 10 mpb	Open Colm 20 Veh/mi 15 mph
Armd Div Tn ¹ —Continued											
53 Repl Co.....	37	4			1	3					
54 Armd QM Bn ¹	334	144			2	142					
55 Hq & Hq Det.....	45	9			2	7					
56 Sup Co.....	147	65				65					
57 Fld Svc Co.....	136	70				70					
58 Armd Ord Bn ¹	687	241			2	239					
59 Hq & Hq Co.....	184	67			2	65					
60 3 Armd Ord Co (ea).....	165	58				58					
61 Ord Contact Party.....	15	6									
62 Armd Med Bn.....	428	98			2	96					
63 Hq & Hq Co.....	104	26			2	24					
64 3 Armd Med Co (ea).....	108	24				24					
65 Amb Plat.....	25	11				11					
66 Litter Plat.....	30	2				2					
67 Clearing Plat.....	33	6				6					
68 Fld Tn (unit).....							192	3.8	11.5	24	47
69 Div Tn.....							514	10.3	30.8	62	124

¹ Includes Med Det.² Includes road space and time interval between march units but not between serials.³ Total SP Veh less Aft and Mtcl.⁴ CC organized tactically. There is no fixed Tac Orgn for a CC and this Orgn is purely arbitrary.⁵ Admin marches only.

k. Average Time Factors—Armored Division.

- (1) This table pertains to G3 time factors considered after an armored division receives a movement order. It gives the times required by the command for—
 - (a) Making preparations before the leading vehicle can arrive at the initial point (IP).
 - (b) Completing the motor march and making preparations to launch a coordinated attack.
- (2) The preparations before the leading vehicle can arrive at the IP are less time consuming than in the infantry division as the armored division is able to move the entire division by organic vehicles. Preparations include transmission of orders by division, briefing of troops, and other normal preparations for an anticipated move. It is standing operating procedure (SOP) for armored division vehicles to be refueled and expended ammunition replaced at once whenever a halt is made or any element of the division enters an assembly area or attack position, thus permitting vehicles to move as soon as personnel and equipment are loaded.
 - (a) If the order were received in daylight for a daylight march, for example, received at 1000, leading vehicle can cross IP at 1045----- $\frac{3}{4}$ hr.
 - (b) If the order were received at night for a night march, for example, received at 2200, leading vehicle can cross the IP at 2300----- 1 hr.
 - (c) If the order were received in daylight for a night march, for example, received at 1100, leading vehicle can cross IP 30 minutes after EENT—30 min after EENT. (For EENT see par. 46f.)
 - (d) If the order were received at night for a daylight march, and more than 1 hour prior to BMNT, for example, received at 0200 hr., leading vehicle can cross IP at BMNT—BMNT (See par. 46f(1).) (If order were received less than 1 hr. prior to BMNT, the time is the time the order was received plus 1 hr.)
- (3) The factors considered in computing time for an armored division to complete a march and make preparations for launching a coordinated attack are dependent upon whether the armored division is organized for combat or not. Generally, it is assumed, unless otherwise stated, that the division is organized for combat in anticipation of the move and commitment to battle. The time factors (b) and (c) apply to any move and are based on the assumption that the division can launch a coordinated attack when two reinforced

battalions (equivalent of one infantry battalion and one tank battalion) of each combat command are in position to attack. If the division formation is a column of combat commands, only the time factors for the leading combat command are computed. If the division formation is combat commands abreast, the time factors for the combat command with the greatest distance to traverse are computed as the factors for the entire division. If an armored division is not organized for combat, time must be allowed (as indicated in (a) below), to permit battalions and supporting units to assemble under a combat command and organize into reinforced battalions under the combat command commander. Other commands, such as the combat command in reserve, division troops, division artillery, division trains, and units placed in division troops, can be assumed to complete their organization in less time than a combat command and therefor are not included as a factor. The organization of combat commands and reinforced battalions may be partially or entirely completed either in bivouac, assembly area or attack position or a combination thereof. The time factor, however, remains the same.

	<i>Day</i>	<i>Night</i>
(a) Organize combat commands and reinforced battalions. (In either one or combination of bivouac, assembly area and attack position, and attack position) -----	45 min.	1 hr. 30 min.
(b) Complete march from old area to new area -----	See (3) above	
(c) Time for final reconnaissance, refueling, and preparations to cross the line of departure or leave attack position (may be a combined assembly area-attack position) -----	30 min.	1 hr.
<i>l. Motor Movement by Echelon.</i>		
(1) <i>Definition.</i> Motor movement by echelon is a movement in which a unit, such as an infantry division, lacking sufficient organic transportation to move all its personnel and equipment in one trip, uses a portion of its transportation to move its foot troops and essential supplies (by complete tactical units) in successive trips until the movement of all has been completed.		

- (2) *Time formula.* The following formula is useful for determining the total time of such a movement:

$$\text{Hours required} = \frac{\text{Number of trips} \times \text{distance in miles}}{\text{Rate of march in miles per hour}} + T$$

- (a) The "number of trips" is the number of trips in either direction; for example, in a 2-echelon movement, three trips would be required—one forward trip to move foot troops, a return trip, and a second trip forward for the remainder of troops and organic loads.
- (b) *T* (a variable) represents the number of hours consumed in unloading and loading personnel and equipment, in turn-arounds at forward and rear assembly areas, and in closing the column into its area of destination. When two routes are available and the movement is made in close column in two echelons, a value of six may be assumed for *T*, as giving a reasonable factor of safety. When more than two routes are available, the value of *T* may be reduced.
- (c) Rate of march in miles per hour represents the average speed of the vehicles in the movement, over a period of time, including short halts.

m. Motor Movement by Echelon—Infantry Division.

- (1) Refer to *l* above for general formula for movement by echelon, and to *a*(1) and *b* above and *c* below for transportation requirements and availability.
- (2) The following example of standing operating procedure for a motor movement by echelon for an infantry division should be used only as a guide from which to prepare plans based upon the actual transportation available and the personnel to be moved.
- (3) *Motor movement 1.*

- (a) *Plan.* Motor movement 1 is a movement in which the division moves in its organic motors in two echelons behind a screen furnished by troops outside the division adequate to protect the movement against strong frontal attack. Combat teams 1 and 2 constitute the first echelon. It moves on one or more routes and protects its immediate front with small advance guards. In addition to its organic transportation, sufficient additional trucks from units of the division not moving in the first echelon are attached to Combat teams 1 and 2 for the movement to transport by motor all their personnel and equipment. At the conclusion of the movement of the first echelon, trucks

belonging to units of the second echelon return to pick up basic loads and move Combat team 3. Necessary trucks from units of the first echelon dump loads in the forward area and return to assist in moving foot troops of the second echelon. Division troops and division trains (less field trains) move in the second echelon. Field trains move with their parent unit.

- (b) *Security.* The reconnaissance company protects the movement by conducting reconnaissance to the front and flanks.
- (c) *Warning order.* Preliminary arrangements for the movement will be inaugurated upon receipt of order "Alert for Motor Movement 1," or "Alert for Motor Movement 1 after designated hour."

MOTOR MOVEMENT 1 (MM1)—1ST INFANTRY DIVISION

First Echelon

Serial 1

CT1:

1st Inf
1st FA Bn
Co A 1st Engr C Bn
Btry A 1st AAA
 AW Bn SP.
Det Sig Co
Det Ord Bn

Serial 2

CT2:

2d Inf
2d FA Bn
Co B 1st Engr C Bn
Btry B 1st AAA AW Bn SP
Det Sig Co
Det Ord Bn

Second Echelon

Serial 3

CT3:

3d Inf
3d FA Bn
Co C 1st Engr C Bn
Btry C 1st AAA
 AW Bn SP.
Det Sig Co
Det Ord Bn

Serial 4

Div Trs:

1st Inf Div Arty (-)
1st Engr C Bn (-)
1st Med Bn
1st Inf Div Hq & Hq Co (-)
1st MP Co (-)
1st Sig Co (-)
1st Tk Bn
1st Recon Co (-)

Serial 5

Div Tns:

Rr Ech Div Hq & Hq Co
Det Sig Co
Det MP Co
1st QM Co
1st Ord Bn (-)
Repl Co
Fld Tns

Motor Movement 1 (MM1)—1st Infantry Division Movement of Foot Troops (MM1)

1		2	3	4
1	Unit from which transport is furnished	Number of 2½-ton trucks provided and unit to which furnished ¹		
		1st Echelon		2d Echelon
		1st Infantry	2d Infantry	3d Infantry
CT 1:				
2	1st Inf.....			36
3	1st FA Bn.....			9
CT 2:				
4	2d Inf.....			36
5	2d FA Bn.....			9
CT 3:				
6	3d Inf.....	36		
7	3d FA Bn.....	9		
Div Trps and Div Tns:				
8	Hq Btry, Div Arty.....	3		
9	4th FA Bn.....	9		
10	AAA Bn (AW) (SP).....		7	
11	Engr Bn (C).....		15	
12	Tk Bn.....	22		
13	QM Co.....		60	
14	Ord Bn.....	9		
15	Sig Co.....		8	
16	Repl Co.....	1		
17	MP Co.....	1		
Total ²		90	90	90

¹ See *n* below for availability of trucks for troop movement.² Total number of trucks required is based on—

Total troops on foot in each infantry regiment—1916.

Passenger capacity of trucks: 2½-ton—25.

(4) *Motor movement 2.*

(a) *Plan.* Motor movement 2 is a movement in which the division moves in its organic motors in two echelons. Combat teams 1, 2, and 3, less one infantry battalion each, move in the first echelon. The infantry battalion from each combat team and the remainder of the troops of the division move in the second echelon. Each combat team dumps basic loads from trucks that can be diverted temporarily from their normal functions to assist in moving some of their own foot troops. Additional trucks to move the remaining foot troops of the first echelon are furnished by units moving in the second echelon. At the conclusion

of the movement of the first echelon, trucks which carried foot troops return to pick up their basic loads. Necessary trucks from each combat team that moved forward in the first echelon with their basic loads, dump their loads in the forward area and return to assist in moving the infantry battalion of their respective combat teams. Field trains move with their parent unit.

- (b) *Security.* The reconnaissance company protects the movement by conducting reconnaissance to the front and flanks.
- (c) *Warning order.* Preliminary arrangements for this movement will be inaugurated upon receipt of order "Alert for Motor Movement 2" or "Alert for Motor Movement 2 after (designated hr)."

MOTOR MOVEMENT 2 (MM2)—1ST INFANTRY DIVISION

First Echelon

CT 1:

1st Inf (less 1 Bn)
1st FA Bn
Co A 1st Engr C Bn
Btry A 1st AAA AW
Bn SP.
Det Sig Co
Det Ord Bn

CT 2:

2d Inf (less 1 Bn)
2d FA Bn
Co B 1st Engr C Bn
Btry B 1st AAA AW
Bn SP.
Det Sig Co
Det Ord Bn

CT 3:

3d Inf (less 1 Bn)
3d FA Bn
Co C 1st Engr C Bn
Btry C 1st AAA AW
Bn SP
Det Sig Co
Det Ord Bn

Second Echelon

1 Bn, 1st Inf

1 Bn, 2d Inf

1 Bn, 3d Inf

Div Trs:

1st Inf Div Arty (-); 1st Engr C Bn (-); 1st Med Bn; 1st MP Co (-); 1st Sig Co (-); 1st Inf Div Hq & Hq Co (-); 1st Tk Bn; Recon Co (-).

Div Tns:

Rr Ech Div Hq & Hq Co; Det Sig Co; Det MP Co; 1st QM Co; 1st Ord Bn (-); Repl Co; Fld Tns.

Assignment of Motor Transport for Movement of Foot Troops (MM2)

1		2	3	4	5	6	7
1	Unit from which transport is furnished	Number of 2½-ton trucks and unit to which furnished					
		1st Echelon			2d Echelon		
		1st Inf (-)	2d Inf (-)	3d Inf (-)	1st Inf (1 Bn)	2d Inf (1 Bn)	3d Inf (1 Bn)
	CTs:						
2	Inf Regts, each.....	10	10	10	25	25	25
3	FA Bn, each.....	4	4	4	4	4	4
	Div Trps and Div Tns:						
4	Hq Btry, Div Arty.....	3					
5	4th FA Bn.....	9					
6	AAA Bn (AW) (SP).....	7					
7	Engr Bn (C).....	15					
8	Tk Bn.....	13	9				
9	QM Co.....		38	28			
10	Ord Bn.....			9			
11	Sig Co.....			8			
12	Repl Co.....			1			
13	MP Co.....			1			
14	Total*.....	61	61	61	29	29	29

*Total number of trucks required is based on total troops on foot in each infantry regiment, 1,916, each infantry battalion, 594.



1

2

3

4

5

6



7

8



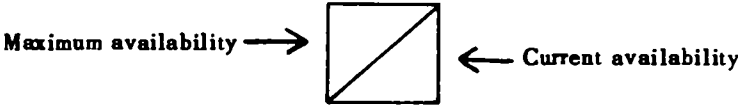
WORKSHEET-VEHICLE AVAILABILITY TABLE^{1 2 3 4 5}

n. Example of Worksheet Showing Availability of Cargo Trucks (2½-ton) in the Infantry Division for Movement of Foot Troops. The following table shows a priority which might be established within a division for the availability of organic motor transportation to be used for movement of foot troops by echelon. The table also can be used in determining the priority of transport to be used in motorizing an infantry unit in reserve, or for cargo hauling. Units of the division report daily the status of transportation. From this information the G4 can make the entries in lower half of the block for each unit.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
Priority		Inf Regt	Inf Regt	Inf Regt	Hq Btry, Div Arty	FA Bn 105-mm How	FA Bn 105-mm How	FA Bn 105-mm How	FA Bn 155-mm How	AAA AW Bn Sp	Engr Bn (C)	Hv Tk Bn	Hq Co, Inf Div	QM Co	Med Bn	Ord Bn	Sig Co	Repl Co	MP Co	Total	Remarks	
		Max																			Max	
		Aval																			Aval	
1	Sup and Gen Cargo	25	25	25	1	8	8	8	8	6	69	20		48		2	4	1	1	199		
2	Orgn Equip	11	11	11	2	1	1	1	1	1	6	2		19		7	4			78		
3	Ki Trk	20	20	20	1	5	5	5	5	5	5	4	4	1	3	2	2	1	1	109		
4	Engr tools and Brg										62									62		
5	Ammo Trk	19	19	19		21	21	21	12	9	2	13								156		
6	Sig Comm	1	1	1	3	1	1	1	1	6	1						8			25		
7	Med	2	2	2	6						1				4					17		
	Total	78	78	78	13	36	36	36	27	27	86	39	4	68	7	11	18	2	2	646		

¹The availability of trucks and priority of such availability are command decisions.
²Prime movers are omitted. See FM 100-5, Para 293.
³Motor maintenance vehicles are omitted.
⁴Command and fire control vehicles are omitted.
⁵Geneva Convention protected vehicles are omitted.
⁶2½-ton dump trucks.
⁷Fifty-six are 2½-ton dump trucks; four of these dump trucks and six 2½-ton cargo trucks are from the bridge platoon.

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56. Movement by Air

a. General.

- (1) The tables in this paragraph are to be used as a guide to determine the aircraft requirements, by type of transport aircraft, for air movement of units of the type field army. For the aircraft requirements for air movement of airborne and infantry divisions or their organic units, see FM 57-30. The following tables are based on data compiled for a theoretical situation which assumes full TOE strength and complete TOE equipment. In applying these tables to actual air movements, bear in mind that the required lift for any unit will fluctuate with the personnel and equipment status of that unit. The tables show numbers of aircraft loads; i. e., the number of sorties, by type of aircraft, required to move a particular unit. Therefore, fewer aircraft than shown may be used to transport the unit if part or all of the aircraft fly more than one sortie.
- (2) The air movement of a large body of troops normally will involve concurrent departures from several airfields and, in air-landed operations, concurrent landing at several terminal air-fields, airstrips, or landing zones in the objective area. The availability of transport aircraft, air installations, and base facilities, the urgency of the situation, and enemy capabilities will be major factors which will determine the number of installations employed as well as the number of sorties to be flown by the transporting aircraft. For considerations governing the employment of air transportation, see FM 100-5 and FM 57-30. For staff procedures, air movement tables, and other forms relative to air movement, see FM 57-30, FM 101-5, and TM 57-210.

b. Aircraft Requirements—Army.

- (1) *General.* The tabulated data in (4)(a), (b) and (c) below represent aircraft requirements for units of a type field army. The data are applicable in planning for airborne operations or the administrative air movement of units of the type field army.
- (2) *Equipment and supplies.*
 - (a) Column 3 of these tables indicates the total weight of each unit in short tons. This figure is the sum of the weights of TOE personnel and equipment, Classes I and III supply for 3 days, and prescribed loads of Class V supply. The prescribed loads of Class V supply may be the same, more, or less than the basic loads of Class V, since they are determined separately for each specific airborne operation.

Normally, the prescribed loads of Class V supply represent 3 days of supply for the specific operation being considered.

- (b) *TOE personnel and equipment.* Unless otherwise indicated, all units are moved at 100 percent personnel and equipment strength. An average weight of 240 pounds per individual is used in determining total personnel weight for a unit. Weights of vehicles are determined by use of net weights given in TM 9-2800, or applicable Technical Manuals.
- (c) *Supply.* The major classes of supply considered are Classes I, III, and V. The accompanying Classes II and IV supply are limited to critical items and are usually in such small amounts that their weights are incidental and therefore are not included.
 - 1. Class I supply is based on 3 days to accompany each unit with an average weight of 17 pounds per man per day.
 - 2. Class III supply is based on the weight of gasoline, oil, and lubricants required to operate vehicles a minimum of 300 miles. Class III requirements for other self-propelled equipment and for fuel-consuming machinery are established on a reasonable hourly operational basis for three days.
 - 3. Class V supply weights are based on the basic load for all units adjusted to a reasonable rate of consumption so as to reflect three days of Class V supply. The weights of Class V supply for some army units have not been included. They are too small to be significant because the greater part is carried by the individual.
- (3) *Aircraft requirements.*
 - (a) Aircraft requirements listed in (4)(a), (b), and (c) below reflect the number of sorties required to transport the various units.
 - (b) The aircraft requirements are based on the following assumed allowable cargo loads.

<i>Type aircraft</i>	<i>Allowable cargo load (lbs)</i>
C-119, medium transport airplane.....	16, 000
C-123, medium assault airplane.....	16, 000
C-124, heavy transport airplane.....	50, 000

- (c) The same allowable cargo load is used for the C-119 and C-123 to facilitate interchanging of loads for planning purposes on a one for one basis. As a result, aircraft are considered in two general groups, medium and heavy.
- (d) Air Force troop carrier units, providing aircraft for the specific operation being considered, will announce to the Army component of the airborne force the allowable cargo

load for each type aircraft that will be employed, because the allowable cargo load will vary with the distance to be flown and other operational conditions.

- (e) In any airborne operation it may be necessary to use types of aircraft other than those listed. However, the data given will serve as a basis for adaptation of the units to be moved to the types of aircraft that are available.
 - (f) Two loading methods are indicated in column 4.
 1. The first load method indicates the aircraft requirements for a given unit when the maximum number of medium aircraft are used. In the event the unit contains heavy or bulky items transportable only in heavy aircraft, the figure in column 6 indicates the minimum number of heavy aircraft required.
 2. The second load method indicates the aircraft requirements when the entire unit is transported in heavy airplanes. If a unit contains equipment not transportable by this class airplane, movement by other means of transportation is required. If accomplishment of the primary mission of the unit is dependent upon the availability of such heavy equipment, it may be necessary to substitute lighter items which are capable of performing similar missions. The heavy tank battalion is an example of a unit with heavy equipment which is nontransportable by heavy transport airplanes.
 3. Units in which the first load method has been omitted are those having quantities of heavy or bulky equipment that preclude efficient loading in medium assault or medium transport aircraft.
 - (g) In selection of a load method by which to transport a unit, careful consideration must be given to the primary mission of the unit and the requirement for the unit in the airhead. During the initial airborne assault, units transported to the objective area will utilize a combination of parachute and medium assault aircraft. Subsequent to the initial assault and after landing fields have been prepared, medium transport aircraft may be used. When airfields are developed sufficiently to handle heavy transport airplanes, units requiring this means of transportation can be phased into the airhead.
- (4) *Tabulated requirements—Army.*

(a) Headquarters and divisions.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Hq & Hq Co, Army.....	51-1-2	277	1	35	-----	3	See FM 57-30. See FM 57-30.
			2	-----	12	23	
Hq, Spl Trp, Army.....	51-3	16	1	2	-----	-----	
			2	-----	1	9	
Hq & Hq Co, Corps.....	52-1A-2A	167	1	21	-----	1	
			2	-----	7	8	
Airborne Div.....	-----	-----	-----	-----	-----	-----	See FM 57-30. See FM 57-30.
Infantry Div.....	-----	-----	-----	-----	-----	-----	

(b) Branches.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Armored:							
Armd Cav Regt.....	17-51A	5508	1	165	168	12	Light tanks substituted for medium tanks.
			2	-----	221	17	
Hq & Hq Co Armd Cav Gp.	17-32A	125	1	7	3	6	Light tanks substituted for heavy tanks.
			2	-----	5	-----	
Tk Bn (120-mm Gun)...	17-35	2452	1	41	87	51	Light tanks substituted for heavy tanks.
			2	-----	99	23	
Artillery:							
Hq & Hq Btry, Corps Arty.	6-501A	229	1	29	-----	4	
			2	-----	10	21	
Hq & Hq Btry, FA Gp.	6-401	138	1	18	-----	6	
			2	-----	6	12	
FA Obsn Bn.....	6-575	1,209	1	105	15	6	
			2	-----	49	16	
FA Searchlight Btry..	6-558A	145	1	-----	-----	-----	Not transportable in medium aircraft without major disassembly of major items.
			2	-----	8	55	
Hq & Hq Btry AAA Brig.	44-101A	91	1	12	-----	5	
			2	-----	4	9	
Hq & Hq Btry AAA Gp.	44-12A	75	1	7	1	6	
			2	-----	3	-----	
AAA Opns Det.....	44-7A	60	1	8	-----	4	
			2	-----	3	15	
AA AW Bn, Mbl.....	44-25A	1,140	1	140	1	5	
			2	-----	46	10	
AAA AW Bn, SP.....	44-75	1,485	1	49	44	7	
			2	-----	60	15	

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Artillery—Continued							
AAA Gun Bn, 90 mm.	44-15A	1,416	1	84	30	6	Estimated aircraft requirements.
			2		57	9	
AAA Bn L, 75-mm Mbl.	44-35A	1,324 (estimated)	1	56	36	24	
FA Bn, 4.5-in Rocket Towed.	6-615	797	2		53	1	Web Tk recovery not air transportable.
			1	97	1	4	
			2		32	3	
FA Bn, 105-mm How SP, Armd.	6-315	1,537	1	49	46	5	Web Tk recovery not air transportable.
			2		62	13	
FA Bn, 155-mm How Towed.	6-135	868	1	81	10	30	Web Tk recovery not air transportable.
			2		35	7	
FA Bn, 155-mm How SP, Armd.	6-325	1,746	1	50	54	4	Web Tk recovery not air transportable.
			2		70	4	
FA Bn, Hv Towed, 155-mm Gun.	6-415A	1,279	1	23	44	5	Not air transportable.
			2		52	21	
FA Bn, Hv, SP, 155-mm Gun.	6-435		1				Not air transportable.
			2				
FA Bn, Hv, Towed, 8-in. How.	6-415A	1,327	1	29	44	5	Not air transportable.
			2		54	23	
FA Bn, Hv, SP, 8-in. How.	6-435A		1				Not air transportable.
			2				
FA Bn, VH, Towed 240-mm How.	6-515A	1,446	1	84	31	1	Tractor M8 substituted for tractor M6. Crane M2, tractor M6 and vehicle tank recovery not air transportable. Weight shown in Col 3 is weight of unit and equipment that is air transportable.
			2		58	4	
FA Bn, VH, Towed 8-in. Gun.	6-515A	1,425	1	82	31	6	Tractor M8 substituted for tractor M6. Crane M2, tractor M6 and vehicle tank recovery not air transportable. Weight shown in Col. 3 is weight of unit and equipment that is air transportable.
			2		57		
FA Bn, 280-mm Gun	6-535A						Data not available.
Arty Rocket Btry (Tent.).	6-538A						Data not available.
FA Missile Bn Cpl (Tent.).	6-545A						Data not available.
AAA Missile Bn (Tent.).	44-145						Data not available.

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Chemical:							
Hq & Hq Co, Cml Gp (Fld).	3-32A	40	1	5			
			2		2	10	
Hq & Hq Det, Cml Smoke Genr Bn.	3-266A	24	1	3			
			2		1	1	
Cml Smoke Genr Co.	3-267A	316	1	40		4	
			2		13	9	
Hq & Hq Co, Cml Bn (Army).	3-36A	10	1	2		6	
			2		1	15	
Cml Maint Co.	3-47A	108	1	8	2	6	
			2		5	17	
Cml Depot Co.	3-67	147	1	9	3		
			2		6	3	
Cml Decon Co.	3-217A	156	1	20		4	
			2		7	19	
Cml Svc Dets:							
Det IB, Tech Intel.	3-500A	14	1	2		2	
			2		1	11	
Engineer Hq & Hq Det:							
Engr Cam Bn, Army.	5-96A	365	1	46		3	
			2		15	10	
Hq & Hq Co, Engr C Gp.	5-192A	96	1	19		56	
			2		4	4	
Engr C Bn, Army.	5-35A	882	1	75	17	143	
			2		36	18	
Hq & Hq Co, Engr Cons Gp.	5-312A	70	1	10		10	
			2		3	5	
Engr Cons Bn.	5-315A	1,785	1	73	50	49	
			2		72	15	
Engr Dp Trk Co.	5-324A	516	1	62	1	5	
			2		21	9	
Engr Hv Equip Co.	5-328A	1,274	1	38	39	5	
			2		51	1	
Engr L Equip Co.	5-367A	1,369	1	37	43	2	
			2		55	6	
Engr Float Brg Co.	5-138A	814	1	40	20	6	
			2		33	11	
Engr Panel Brg Co.	5-137A	544	1	53	5	5	
			2		22	6	
Engr Pon Brg Co.	5-139A	1,473	1	150	11	2	
			2		59	2	
Engr Aerial Photo Repro Co.	5-54	301	1				Not air transportable in medium aircraft.
			2		15	74	
Engr Topo Bn, Army.	5-55A	412	1	34	9	85	
			2		17	13	
Engr Topo Co, Corps.	5-167A	172	1	15	3	23	
			2		7	8	
Hq & Hq Co Engr Maint Sup Gp.	5-262	150	1	19		2	
			2		6		
Hq & Hq Det, Engr Dep Bn.	5-266A	38	1	6		10	
			2		2	12	
Engr Dep Co.	5-267	365	1	21	10	3	
			2		15	10	
Engr Sup Pt Co.	5-48A	178	1	10	4	2	
			2		8	22	

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Engineer Hq & Hq Det—Continued							
Engr Fld Maint Co.....	5-157	284	1	14	9	53	
			2		12	16	
Engr WS Co.....	5-67	221	1	30		19	
			2		9	4	
Team, Fire Fighting...	5-500A	35	1	5		5	
			2		2	15	
Team, Sp Equip Maint.	5-500A	133	1	11	2	5	
			2		6	17	
Engr Tech Intel Team Coll.	5-500A	7	1	1		1	
			2		1	18	
Engr Tech Intel Team Research.	5-500A	12	1	2		4	
			2		1	13	
Infantry:							
Inf Hv Mort Bn.....	7-45	596	1	75		4	
			2		24	4	
Inf Regt (Sep).....	7-11A	2,270	1	244	22	232	
			2		91	5	
Medical:							
Hq & Hq Det, Med Gp.	8-22A	27	1	4		5	
			2		2	23	
Hq & Hq Det, Med Bn (Sep).	8-26A	27	1	4		5	
			2		2	23	
Med Coll Co (Sep).....	8-27A	83	1	11		5	
			2		4	17	
Med Cir Co (Sep).....	8-28A	69	1	10		11	
			2		3	6	
Med Holding Co.....	8-57A	72	1	9			
			2		3	3	
Med Amb Co (Sep).....	8-317A	192	1	24			
			2		8	8	
Preventive Medicine Co.	8-117A	112	1	14			
			2		5	13	
Med Fld Lab, Army...	8-640A	57	1	8		7	
			2		3	18	
Army Med Dep.....	8-667	241	1	27	1		
			2		10	9	
Mbl Army Surg Hosp..	8-571A	95	1	12		1	
			2		5	30	
Shock Det, KC.....	8-500A	7	1	1		1	
			2		1	18	
Maxillo-Facial Det, KD.	8-500A	7	1	1		1	
			2		1	18	
Neurosurgical Det, KE.	8-500A	7	1	1		1	
			2		1	18	
Thoracic Det, KF.....	8-500A	7	1	1		1	
			2		1	18	
Gas Det, KG.....	8-500A	20	1	3		4	
			2		1	5	
Dental Svc Det, KJ....	8-500A	40	1	3	1	9	
			2		2	10	
Dental Prosthetic Det, KK.	8-500A	11	1	1	1	22	
			2		2	39	
Psychiatric Det, KO...	8-500A	18	1	3		6	
			2		1	7	

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Medical— Continued							
Gen Disp, MA.....	8-500A	15	1	2		1	
			2		1	10	
Med Det, OA.....	8-500A	11	1	2		5	
			2		1	14	
Evac Hosp, SmbL.....	8-581A	300	1	40		20	
			2		12		
Evac Hosp (750 hed)...	8-580A	333	1	44		19	
			2		14	17	
Conv Cen, Army.....	8-590A	329	1	42		7	
			2		14	21	
Hq, Professional Svc, AG.	8-500A	11	1	2		5	
			2		1	14	
Optical Det, GA.....	8-500A	8	1	1			
			2		1	17	
Optical Det, Aug, GB...	8-500A	4	1	1		4	
			2		1	21	
Vet Food Insp Det, S, JA.	8-500A	8	1	1			
			2		1	17	
Surgical Det, KA.....	8-500A	6	1	1		3	
			2		1	20	
Orthopedic Det, KB...	8-500A	8	1	1			
			2		1	17	
Helicopter Amb Unit, RA.	8-500A	52	1	7		4	Does not include helicopters.
			2		3	23	
Hq Vet Service, AF....	8-500A	4	1	1		4	
			2		1	21	
Autmv Maint Det.....	29-500	4	1	1		4	
			2		1	21	
Military Police:							
MP Bn, Army.....	19-35A	102	1	27		14	
			2		9	23	
MP Co, Corps and Army.	19-37A	63	1	8		1	
			2		3	12	
Bn Hq & Hq Det (AD).	19-500	22	1	3		2	
			2		1	3	
MP Esc Gd Co.....	19-47A	103	1	15		17	
			2		5	22	
MP Gd Co.....	19-247A	34	1	5		6	
			2		2	16	
Crim Inves, ME.....	19-500A	27	1	4		5	
			2		2	23	
Crim Inves, MD.....	19-500A	15	1	2		1	
			2		1	10	
Crime Lab (Mbl), MG.	19-500A	13	1	2		3	
			2		1	12	
Ordnance:							
Hq & Hq Co, Ord Gp..	9-12A	118	1	15		2	
			2		5	7	
Hq & Hq Det, Ord Bn.	9-76A	53	1	7		3	
			2		3	22	
Ord Dir Spt Co.....	9-7	574	1	35	12	6	
			2		23	1	
Ord, Dir Autmv Spt Co.	9-127	457	1	33	8	7	
			2		19	18	
Ord Hv Maint Co.....	9-9	701	1	16	23	2	
			2		29	24	

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Ordinance—Continued							
Ord HAM Co.....	9-197	530	1	4	20	2	
			2		22	20	
Ord Fld Sup Co.....	9-57A	519	1	6	19	4	
			2		21	6	
Ord Recovery and Clas Co.	9-167A	373	1	19	9	4	
			2		15	2	
Ord Arty Veh Park Co..	9-137A	251	1	26	2	7	
			2		11	24	
Ord Ammo Co (Army)..	9-17	222	1	25	1	3	
			2		9	3	
Ball Tech Svc Intel Det, BA, BC.	9-510	56	1	4	1	1	
			2		3	19	
Explo Ord Disposal, AA.	9-510	24	1	1	1	9	
			2		2	26	
Tech Intel Det, BB....	9-510	8	1	1			
			2		1	17	
Integ Fire Con Det....	9-510	26	1	1	1	7	
			2		2	24	
Ord Sp Wpns SW Dir Spt Co, T.	9-49						Data not available.
Quartermaster:							
Hq & Hq Co, QM Gp..	10-22A	34	1	5		6	
			2		2	16	
Hq & Hq Det, QM Bn..	10-536A	42	1	6		6	
			2		2	8	
QM Bkry Co.....	10-147	217	1	21	2	1	
			2		9	8	
QM Clo Gen Sup Dep Co.	10-227	76	1	10		4	
			2		4	24	
QM Subs Dep Co.....	10-357	77	1	10		3	
			2		4	23	
QM Ldry Co.....	10-167	192	1	24			
			2		8	8	
QM Refrg Co.....	10-247A	491	1	9	17	6	
			2		20	9	
QM Sales Co.....	10-157A	172	1	22		4	
			2		7	3	
QM Svc Co.....	10-67	95	1	12		1	
			2		4	5	
QM Petrl Sup Co.....	10-77	297	1	35	1	8	
			2		12	3	
QM Bath Co (SmbL)...	10-257A	65	1	9		7	
		(estimated)	2		3	10	
QM Gr Reg Co.....	10-297A	127	1	16		1	
			2		6	23	
QM Relm Maint Co (SmbL).	10-237A	96	1				Not transportable by medium aircraft.
			2		5	29	
QM Salv Co.....	10-187A	122	1	9	2		
			2		5	3	
QM Subs Sup Co.....	10-197A	110	1	14		2	
			2		5	15	

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in short tons	Remarks
				C-123, C-119	C-124		
Signal Corps:							
Sig Bn Corps.....	11-15	2,284	1	233	17	5	
			2		92	16	
Hq & Hq Co.....	11-16A	166	1	15	2	4	
			2		7	9	
Rad Msg Cen Opn Co.	11-17A	384	1	45	1	1	
			2		16	16	
Wire Rad Relay Opn Co.	11-18	327	1	35	2	3	
			2		14	23	
Cons Co.....	11-27A	469	1	22	12	7	
			2		19	6	
Hq & Hq Det, Sig Gp..	11-22A	54	1	7	0	2	
			2		3	21	
Sig Cons Bn.....	11-25	2,014	1	190	20	6	
			2		81	11	
Hq & Hq Co.....	11-26A	138	1	6	4	10	
			2		6	12	
Sig Cons Co.....	11-27A	469	1	22	12	7	
			2		19	6	
Sig Opn Bn.....	11-95	1,655	1	157	16	1	
			2		67	20	
Hq & Hq Co.....	11-96	127	1	13	1	2	
			2		6	23	
Co (Wire Opn).....	11-97	481	1	36	8	7	
			2		20	19	
Co (Rad Opn).....	11-98	667	1	72	4	9	
			2		27	8	
Co (Msg Cen Opn)...	11-99	332	1	33	3	7	
			2		14	18	
Hq & Hq Det, Sig Spt Bn.	11-116A	72	1	9		0	
			2		3	3	
Sig Spt Co.....	11-117A	1,768	1	236	0	120	
			2		71	7	
Sig Rep Co.....	11-127	775	1	60	12	5	
			2		31		
Sig Dep Co.....	11-128A	420	1	34	6	2	
			2		17	5	
Transportation Corps:							
Hq & Hq Co, Trans Hwy Trans Gp.	55-12A	45	1	6		3	
			2		2	5	
Hq & Hq Co, Trans Trk Bn.	55-16A	66	1	6	1	7	
			2		3	9	
Trans Lt Trk Co.....	55-17	366	1	50	1	59	
			2		16	34	
Trans Car Co.....	55-19A	235	1	38		69	
			2		10	15	
Mov Con Team.....	55-500A	60	1	8		4	
			2		3	15	

(c) *Miscellaneous.*

1	2	3	4	5	6	7	8
Unit	TOE	Total weight unit in short tons	Load method	Aircraft requirements		Unused allowable cargo load in tons	Remarks
				C-123, C-119	C-124		
Miscellaneous:							
Hq & Hq Det, Repl Gp.	20-52	46	1	6	-----	2	
			2	-----	2	4	
Hq & Hq Det, Repl Bn.	20-56	36	1	5	-----	4	
			2	-----	2	14	
Repl Co.-----	20-57	12	1	2	-----	4	
			2	-----	1	13	
Army Postal Unit, Type R.	12-605	5	1	2	-----	11	
			2	-----	1	20	
Army Postal Unit, Type V.	12-605	5	1	2	-----	11	
			2	-----	1	20	
Army Postal Unit, Type W.	12-605	8	1	2	-----	8	
			2	-----	1	17	
Sec Disbursing, Fin (AD, FP, GB, HC).	14-500A	10	1	2	-----	6	
			2	-----	1	15	
Spl Svc Co.-----	12-17	125	1	10	2	5	
			2	-----	5	-----	
Photo Intpr Tm.-----	30-000A	8	1	1	-----	0	
			2	-----	1	17	
Mil Intel Svc Orgn.-----	30-600A	213	1	27	-----	3	
			2	-----	9	12	
Mil Govt Gp.-----	41-500A	82	1	11	-----	6	
			2	-----	4	18	
Mil Govt Co.-----	41-500A	51	1	7	-----	5	
			2	-----	3	24	
Mil Govt Plat (AA)---	41-500A	12	1	2	-----	4	
			2	-----	1	13	
Loudspeaker & Leaflet Co.	20-77A	108	1	11	2	30	
			2	-----	5	17	

Plat Hq only—
Does not include
all operational
personnel.

57. Movement by Water

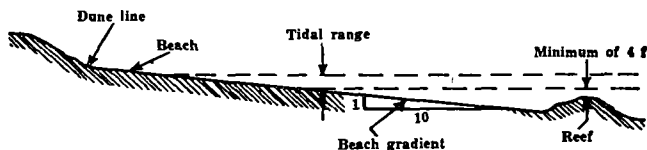
a. Capacities of ships and craft, sea distances, steaming rates, turn-around times, and factors for cargo shipping are contained in chapter 7.

b. *Amphibious Assault.*

- (1) *Beach analysis and selection.* Strategic considerations aside, the selection of a beach for an assault landing is based upon the potential of the beach and hinterland to permit the initial landing and the followup logistical support of the forces required for the operation until such time as port facilities can be established. From a logistical standpoint, the most important considerations are the characteristics of the beach, beach exits, and hinterland, and the forecast weather conditions as they influence the ability of the service forces to support and maintain the forces ashore.

- (2) *Considerations in selecting.* The factors of primary importance when investigating beaches for amphibious landings are as follows:

(a) *Hydrographic.* Hydrographic factors to be considered are tides, surfs, beach gradients, reefs, and characteristics of bottom and beach surfaces. (The diagram below depicts certain of the features discussed.)



- (b) *Tides.* The stage of the tide and the tidal range are considered as they affect the passage of underwater obstacles, offshore bars, reefs or shoals, the beaching or stranding of landing craft, and the width of the beach available for operations.
- (c) *Surf.* Waves breaking onto a beach may cause landing craft to broach to. This necessitates a study of surf in connection with landing operations. Surf action is dependent on wind, tide and the depth of water. On flat beaches, waves break and are spent before reaching the shoreline. Over steep slopes the surf breaks near the shore and consequently will have more effect on the beaching of craft. Waves usually break over reefs where they exist, and thus leave the inner area relatively unaffected. LCVP's can operate satisfactorily in a surf of 3 or 4 feet, DUKW's in a surf of 3 to 5 feet; in greater surfs, operations should be undertaken only in an emergency.
- (d) *Beach gradient.* Gently shelving beaches cause landing craft to ground at a considerable distance from the shoreline, which increases the hazard and time of unloading. A beach gradient of 1 on 10 is nearly ideal. Steep gradients are difficult in bad weather because of surf conditions and the difficulty of getting cargo away from landing craft.
- (e) *Reefs.* In many places, reefs or shoals fringe the shorelines and must be studied prior to beaching operations. A minimum depth of water of 4 feet should be available over reefs or shoals at low tide. This is not the normal situation since most reefs are either very close to the surface or entirely exposed at low tide, in which case certain craft must operate at high tide only. Reefs or shoals which limit operations should be avoided in the selection of beach sites.

- (f) *Weather.* Predicted weather conditions must be considered in relation to the projected operation. Adverse weather conditions and their effects upon tide and surf may make the operations too hazardous, or impossible. Haze or fog conditions may be advantageous or disadvantageous, depending upon overall considerations of the operation in question. The weather considerations should cover the entire operation and insure favorable conditions for not only the assault landings, but also the followup and buildup phases.
- (g) *Topographic.* Having effected a lodgment ashore the landing forces will be confronted with expanding the beachhead and general movement inland. Here topographic features are of immediate importance. Consideration should be given to overall length of beach, degree of access to the beach (number of corridors and utility of each, the existing road net to and from the beach), areas suitable for supply dumps (both in the beach area and inland), and cover and concealment. It is important that each of these factors be analyzed with respect to the advantages or disadvantages that a particular site may offer.
- (h) *Equipment.* Requirements for equipment to approach and unload supplies over the beach must be determined by beach characteristics. If available equipment will not be adequate, early effort must be directed toward the procurement of sufficient amounts of the proper types.
- (i) *Enemy action.* This may take either an active or a passive form. Active enemy action includes the use of existing defense installations, established fields of fire, and employment of the defending forces. Enemy air and naval capabilities also must be considered. Passive enemy action includes obstacles, demolitions, and mines in water adjacent to the beach, on the beach, and immediately inland. All of these will affect the ability of the service troops to furnish the necessary logistic support.
- (j) *Troop availability.* An analysis must be made of troops available for the operation which will include the degree of training, experience, and general suitability of both combat and service elements for the operation under consideration.
- (k) *Time.* The time and place for launching an operation are decided after an analysis of the factors discussed in (a) through (j) above. In addition, the exact time (week, day, and hour) for the assault will be influenced

by visibility (as it affects surprise and operations) in the relative number of hours of darkness, moonlight, and daylight. Whether the landing is made in darkness or daylight is determined largely by the relative effectiveness of the fire and support of the assaulting and defending forces.

(3) *Beach capacity for assault landing.*

- (a) *Size of beaches.* The number of troops which can be landed simultaneously in assault over a given beach is the result of a combination of factors. The tactical formation employed by the assault troops should be the dominant factor, provided safety precautions and good judgment are not sacrificed. In general, the width of beach employed for landing an infantry battalion or other organization in assault should conform to the normal frontage assigned for land combat. For the infantry battalion this normally will be not less than 500 yards nor more than 1,000 yards, an average of 750 yards.
- (b) *Time and space factors for landing craft and amphibian tractors.* The interval between landing craft or amphibian tractors landed simultaneously on a beach will vary from 50 yards to 100 yards, an average of 75 yards. The time interval between waves will vary from 1 minute to 15 minutes.
- (c) *Average landing times.* The battalion landing team of approximately 1,300 men requires an average of 55 amphibian tractors or 40 landing craft (LCVP). These are divided into waves, with each successive wave organized to ensure a logical tactical buildup on shore. The number of waves varies from three to seven depending upon beach frontage, restricted offshore passages caused by natural and artificial obstacles, the tactical plan ashore, and contemplated enemy resistance. As a rule of thumb, a battalion landing team in assault should be landing on the beach in 30 minutes. A shorter time lapse is desirable when practicable.
- (d) *Followup waves.* Experience indicates that waves of boats landed subsequently to the assault battalion normally will take longer to unload because they carry more vehicles and supplies. At least 15 minutes' time interval should be allowed between these waves. However, the increased time interval between waves is offset by the ability to land boats closer together.

- (e) Assault shipping required for a reinforced infantry division varies according to the tactical mission and the length of the voyage.

1. For long voyages (10 days, for example) primary consideration must be given to provision of the type of shipping that will negotiate the distance at a suitable speed and that will best accommodate the embarked troops. APA's and AKA's meet these requirements better than landing ships. Assault shipping for a reinforced infantry division for an extended voyage, therefore, conforms to the following average pattern:

Type ship	Personnel	Vehicles	No. of ships	Total personnel	Total vehicles
APA.....	1,500	50	15	22,500	750
AKA.....	300	120	6	1,800	720
LST*.....	300	60	12	3,600	720
LSM*.....	50	10	12	600	120
LSD*.....	200	50	3	600	150
Total.....				29,100	2,460

*Number of landing ships varies in proportion to number of amphibian tractors, DUKW's ground combat vehicles, and LCT's and LCM's to be carried.

2. For short voyages (48-72 hrs, for example) accommodation of embarked troops can be subordinated to provision of the most suitable shipping for ease and efficiency in loading and unloading. Landing ships meet these requirements better than APA's and AKA's, especially when ground combat vehicles and amphibian tractors are considered. Assault shipping for a reinforced infantry division for a short voyage, therefore, conforms to the following pattern:

Type ship	Personnel	Vehicles	No. of ships	Total personnel	Total vehicles
APA.....	1,500	50	9	13,500	450
AKA.....	300	120	6	1,800	720
LST*.....	300	60	36	10,800	2,160
LSM*.....	50	10	12	600	120
LSD*.....	200	50	3	600	150
Total.....				27,300	3,600

*Number of landing ships varies in proportion to number of amphibian tractors, DUKW's, ground combat vehicles, and LCT's and LCM's to be carried.

3. It will be noted, in comparing the patterns of assault shipping for extended and short voyages, that although the personnel lift remains approximately equal, the number of vehicles lifted in the assault shipping for a short voyage greatly exceeds the number lifted in the assault shipping for a long voyage. This is due to the fact that the landing ships carry a balanced personnel and vehicle load as compared with APA's which carry large numbers of personnel but few vehicles.

4. Available shipping will always affect the composition of assault shipping. Efficient loading and allowable overloads likewise affect the number of personnel and vehicles that can be loaded. For example, it was common in both Europe and the Pacific to load 500 troops on LST's.

(f) *Vehicles and supply.* Vehicles and supply carried by the assault and early followup waves may be substituted for men as given in the above tables on the basis of space or weight, whichever is the determining factor in each case. The boat space occupied by one man and his individual equipment normally is considered to be 224 pounds, 13.5 cubic feet or 3 square feet.

c. *River Crossing.*

(1) *Bridges.* In an assault on a river line, the number of bridges provided for each tactical unit will vary widely depending upon many factors. Some of these are width of river, stream velocity, the available road net, trafficability of the soil, the types and amounts of equipment available, and the number of available engineer troops. As a rule, at least one floating bridge to take division loads will be necessary within the zone of each assault division. These bridges normally will be supplemented by one additional bridge per corps zone and at least one in the army zone. Communications zone troops ordinarily will provide a railroad bridge in the zone of each army.

(2) *Ferries.* In addition to the factors discussed above, the numbers and types of ferries used will be affected by the number of bridges planned and by the extent to which landing craft and amphibious vehicles are employed. For narrow streams, it frequently will be more economical to construct a bridge at each available site than to use ferries. On the other hand, in crossing a wide river when the construction of bridges will be delayed, ferries of all types will be used to the greatest degree possible.

- (3) Detailed characteristics of bridging and ferrying equipment are shown in paragraphs 73 and 74.

Section III. TRAINING

58. Maneuver Area

a. Divisional weapons, particularly the 90-mm and 120-mm tank guns, have outmoded the criteria applicable for World War II training ranges. The 90-mm tank gun should be allowed a minimum of 24,400 yards (13.9 miles) to permit fully realistic training in combat fire. The 120-mm gun requires a firing range of 35,000 yards (19.9 miles). Consequently, installations which have previously been utilized for training of divisions are no longer capable of meeting fully the present day requirements.

b. Data on installation areas in approximate acreages are as follows:

Type units	Approximate number troops	Cantonment area	Miscellaneous activities area	Field exercise area	Firing and impact area	Total
Inf Div.....	¹ 30,000	2,200	1,000	50,000	90,000	143,200
Armd Div.....	¹ 30,000	2,200	1,000	70,000	140,000	213,200
Abn Div.....	¹ 30,000	2,200	1,000	50,000	² 90,000	143,200
Corps Troops.....	³ 30,000	2,400	1,000	10,000	40,000	53,400
AAA Firing Center.....	⁴ 2,500	⁴ 250	⁴ 150	⁵ 6,000	⁵ 70,000	76,400
Tank Firing Center.....	⁶ 2,500	⁶ 250	⁶ 150	Not required	140,000	140,400

¹ Includes divisional, nondivisional and supporting troops (aggregate strength).

² Consideration must be given to cleared areas for drop zone and assault transport landing areas. An airdrome capable of taking large transports should be nearby. An airborne division maneuver area should contain an airfield, capable of handling large airplanes, immediately adjacent to the cantonment area. One or more large drop and assault transport landing zones should be located near the cantonment area, and the others scattered throughout the maneuver area. At least one such zone should be located adjacent to the firing and impact area to permit conduct of small unit problems using live ammunition.

³ Normal assignment of corps troops plus one-third of normal army engineer and army AAA units.

⁴ Per group of two AW battalions and one gun battalion.

⁵ Provides position areas and danger areas for simultaneous firing of three gun battalion through 45° safety angle. Danger area may be sited over water.

⁶ Per 3 tank battalions and proportionate station overhead.

59. Training Facilities for Infantry, Airborne and Armored Divisions

a. The cantonment area should be located near the perimeter of the land available, accessible to highways and railroad facilities. The area should provide all housing, storage, railroad yards, administration, shops, close-in training areas, miscellaneous training courses and recreational facilities. For a functional layout of division type camps see OCE drawing number E-16-06-21 and E-16-06-22 obtainable from Office, Chief of Engineers.

b. The miscellaneous activities area includes the station hospital, airfields, divisional review field, and other administrative activities not included in the cantonment area.

c. The field exercise area includes all available land except that used for cantonment, miscellaneous activities, and firing and impact area. Portions of the firing and impact area not in use when the exercises are conducted may be utilized as field exercise area. It is desirable that this area contain streams or lakes for training in construction of fixed and floating bridges.

d. Firing and impact area permits the firing of all ranges simultaneously, except, in some cases, those whose impact areas are superimposed. For suggested layout see SR 210-20-20. This area should be of size shown therein and of varied terrain with suitable locations for ground observation points. The impact area may be submarginal or swamp land.

e. The division review field should be an area at least 3,000 by 1,000 yards, adjacent to or near the cantonment area.

f. Drill fields should be located in close proximity to each regimental area.

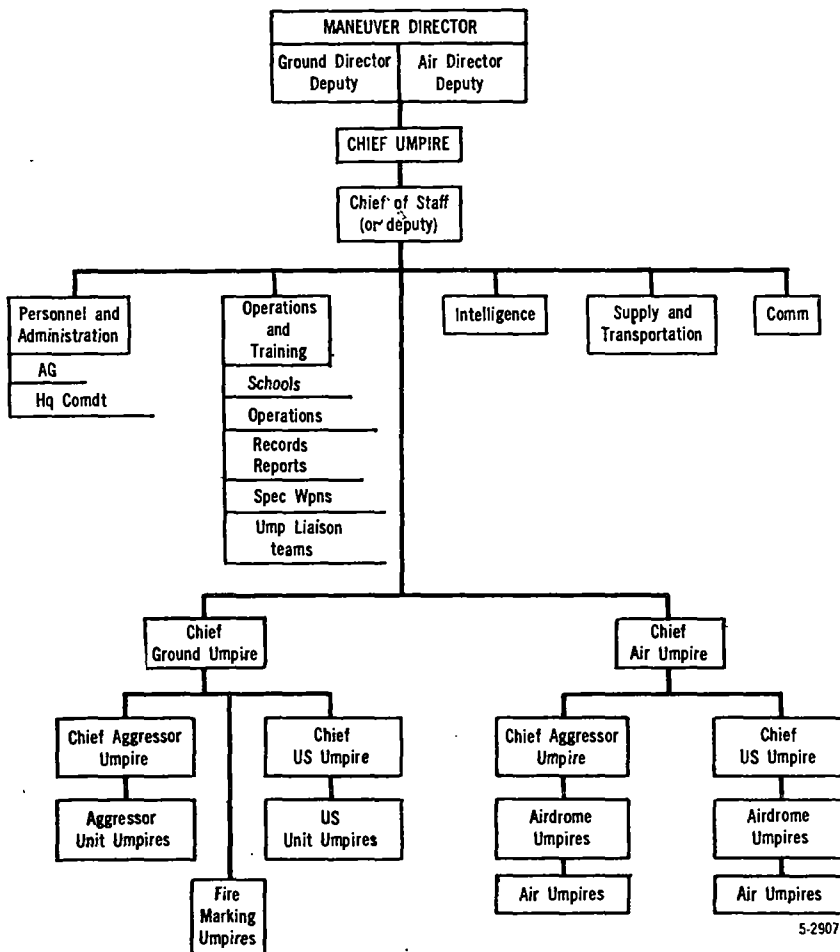
g. The landing field requires suitable terrain, and should be available in the vicinity of the cantonment area for use by organic aircraft.

h. An airfield suitable for use by large numbers of transport aircraft should be on or near the installation.

i. The close-in training area, in order to permit the maximum use, should be located in close proximity to the housing area.

j. Ranges for the infantry, airborne, and Armored Division posts may be found listed in SR 210-20-20 together with the number of ranges, positions, lanes, bays or firing points required for each type of unit, also the drawing number from which they may be constructed and the appropriate training manual reference.

60. Umpire Organization



5-2907

• NOTE: A Naval Deputy and a Chief Naval Umpire will be included in a Joint Army-Navy-Air Force exercise.

61. Umpire Requirements

For umpire requirements, see FM 105-5.

Section IV. TACTICAL OPERATIONS

62. Characteristics of Weapons

a. Vehicular Weapons, Combat Vehicles (Less Artillery).

1	Vehicle	Primary weapon	Sustained rate of fire	Effective range (yds)	Area of burst (HE)
2	Carriage, Motor, Multiple Gun, M16A1.	MG Cal .50, M2(4)-----	1,800	7125 (Hor) ..	
3	Carriage, Motor, Twin 40mm Gun M19A1 or T141.	Gun, Dual Auto-----	120	5500-----	
4	Carrier, 81mm Mortar, M21-----	Mortar, 81mm-----	18	2600-----	17-20 yd radius.
5	Carrier, Heavy Mortar-----	Mortar, 4.2 in., M30-----	15	5850-----	45 x 15 yd.
6	Landing Vehicle, Tracked, Armored, Mk IV, Mk V.	How, 75mm, M3-----	3	9550-----	30 x 10 yd.
7	Gun, 90mm, SP, T101 (Abn)-----	Gun, 90mm, T125-----	Will be furnished when available.		
8	Tank, 76mm Gun, M41-----	Gun, 76mm, M32-----			
9	Tank, 90mm Gun, M47-----	Gun, 90mm, T119-----	1	2000 AP-----	33 x 6.
10	Tank, 90mm Gun, M48-----	Gun, 90mm, T130-----	1	15000 HE-----	40 x 12.
11	Tank, 120mm Gun, T43-----	Gun, 120mm, T123E1-----	1	2000 AP-----	40 x 12.
				29500 HE-----	50 x 9.

¹ First 20 min.

b. Infantry Weapons.

1	2	3	4	5	6
Weapon	Maximum rate of fire rds/m	Sustained rate of fire rds/m	Maximum range (yds)	Maximum effective range (yds)	Effective radius of burst (yds)
2 Carbine, cal .30, M2-----	750-775-----	40-60-----	2,200	300	
3 Grenade, hand fragmentation, Mk IIA1.			35-40	35-40	10
4 Grenade, hand, offensive, Mk IIIA1-----			35-40	35-40	
5 Grenade, rifle, fragmentation, M17-----			290	290	3-5
6 Grenade, AT, M9A1-----	4-----	4-----	365	(¹)	10
7 Flame thrower, portable, M2A1-----		8-9 seconds.			
Unthickened fuel-----				20	
Thickened fuel-----			55-65	45	
8 Machine gun, heavy, cal .30, M1917A1.	450-600-----	125-----	3,500		
Antiaircraft-----				700	
Ground-----				2,000	
9 Machine gun, light cal .30, M1919A6-----	400-550-----	75-----	3,500		
Antiaircraft-----				700	
Ground-----				2,000	
10 Machine gun, light, cal .30, M1919A4-----	400-550-----	75-----	3,500		
Antiaircraft-----				700	
Ground-----				2,000	
11 Machine gun, heavy, cal .50, HB M2, on grd mount, M3.	400-600-----	40-----	7,400		
Antiaircraft-----				1,000	
Ground-----				2,000	

¹ 75 pt. tgt 330 area tgt.

	1	2	3	4	5	6
1	Weapon	Maximum rate of fire rds/m	Sustained rate of fire rds/m	Maximum range (yds)	Maximum effective range (yds)	Effective radius of burst (yds)
12	Mortar, 60-mm, M19 with mount, M5. Shell, HE M49.....	30-35.....	18.....	1,985	1,985	20×10
	Shell, WP M302.....			1,610	1,610	11
13	Mortar, 60-mm, M19 with baseplate M1.....	10-15.....	10.....	816	500	20×10
14	Mortar, 81-mm, M1 with mount, M4. Shell, HE, M43.....	30-35.....	18.....	3,200	3,200	25×15
	Shell, HEH, M56.....			2,596	2,596	30×20
	Shell, WP, M57.....			2,465	2,465	17
	Shell, H11, M301.....			2,450	2,450	0
15	Mortar, 4.2-in., M30. Shell, HE, M329.....	20 (2 min)	5 (20 min)	6,000	5,850	45×15
16	Pistol, automatic, cal .45, M1911A1.....	21-28.....	10.....	1,640	50	
17	Rifle, automatic, Browning, cal .30, M1918A2.....	350-550.....	40-60.....	3,500	500	
18	Rifle, cal .30, M1.....	16-32.....	16.....	3,500	500	
19	Rifle, cal .30, M1C and M1D.....	10-15.....	10.....	3,500	800-1,000	
20	Rifle, 57-mm, M18.....	8.....	2.....			
	Cartridge, HE, M306.....			4,340	1,900	34×10
	Cartridge, HEAT, M307.....			4,340	1,200	0
	Cartridge, smoke, WP, M308.....			4,340	1,900	11
21	Rifle, 75-mm, M20.....	8.....	2.....			
	Cartridge, HE, M309.....			6,955		45×15
	Direct fire.....				2,100	
	Indirect fire.....				6,955	
	Cartridge, HEAT, M310.....			7,200	1,700	0
	Cartridge, smoke, WP, M311.....			7,020		
	Direct fire.....				2,100	15
	Indirect fire.....				7,020	
22	Rifle, 105-mm, M27.....	7.....	2.....			
	Cartridge, HE.....			9,300	9,300	50×15
	Cartridge, AT.....			9,300	1,700	
	Cartridge, smoke.....			9,300	2,600	
	Direct fire.....				2,600	
	Indirect fire.....				9,300	
23	Rocket launcher, 3.5-in., M20.....	8.....	4.....	900		20×10
	Area targets.....				900	
	Point targets.....				400	
24	Submachine gun, cal .45, M3A1.....	450.....	40-60.....	1,760	100	

c. Artillery Weapons.
(1) Field artillery.

	1	2	3	4	5	6	7	8
1	Type, caliber, and carriage model	Time to emplace (min.)	Maximum rate of fire (rounds per min.) ¹	Projectiles				
				Effective area of burst (yds)		Weight (lbs)	Maximum range (yds)	
				Lateral	Range		100 percent	85 percent
2	75-mm pack howitzer (carriage, M8).	3 to 7.....	16	30	10	14.7	9,610	8,168
3	76-mm gun, M1A2 (motor carriage, M18).	-----	20	30	10	² 15.4	14,200	12,070
4	105-mm howitzer, M2A1 and M2A2 (carriage, M2A2).	3.....	8	50	15	² 23.7	³ 5,000	-----
5	105-mm howitzer, M4 and M4A1 (motor carriage, M37).	-----	8	50	15	33	12,205	10,374
6	105-mm howitzer, SP, T96E1 (motor carriage, T98E1).	-----	8	50	15	33	12,205	10,374
7	4.5-inch multiple rocket launcher, M21.	2.....	25	50	15	42.5	6,300	5,355
8	155-mm howitzer, M1 and M1A1 (carriage, M1A2).	5.....	2	60	18	95	16,355	13,902
9	155-mm howitzer, M1 and M1A1 (motor carriage, M41).	1.....	2	60	18	95	16,355	13,902
10	155-mm howitzer, SP T186E1 (motor carriage T194).	-----	2	60	18	95	16,355	13,902
11	155-mm gun, M2 and M2A1 (carriage, M1).	½ to 6 hrs...	2	60	18	95	25,715	21,857
12	155-mm gun, M2 and M2A1 (motor carriage, M40).	1.....	2	60	18	95	25,715	21,857
13	155-mm gun, SP, T80 (motor carriage, T97).	-----	2	60	18	95	25,715	21,857
14	8-in. howitzer, M2 (carriage, M1).	½ to 6 hrs...	1½	80	20	200	18,510	15,733
15	8-in. howitzer, M2 (motor carriage, M43).	1.....	1½	80	20	200	18,510	15,733
16	8-in. howitzer, SP, T89 (motor carriage, T108).	-----	1½	80	20	200	18,510	15,733
17	8-in. gun, M1 (carriage, M2)...	1 to -----	½	80	20	240	35,490	30,166
18	240-mm howitzer, M1 (carriage, M1).	1 to 6 hrs...	½	100	25	360	25,225	21,441
19	280-mm gun, T131 (carriage, T72).	12.....	½	200	60	600	⁴ 15,179	12,902
							⁴ 31,200	26,520
							⁴ 13,900	⁴ 11,815

¹ Not applicable for sustained fire.

² Armor-piercing projectile.

³ Armor-piercing projectile against armored targets.

⁴ Using minimum powder charge.

(2) *Antiaircraft artillery* (including automatic weapons).(a) *General.*

	1	2	3	4	5	6	7
1	Type, model and carriage model	Time to emplace (min.)	Maxi- mum rate of fire (rounds per min.)	Range (yds)			
				Horizontal		Vertical	
				Maxi- mum	Fuse limit	Maxi- mum	Fuse limit
2	Motor carriage, M16, with multiple (4) cal .50 machinegun mount, M45.	-----	1,800	7,125	-----	¹ 7,000	-----
3	Trailer, multiple (4) cal .50 machinegun mount, M55.	² 3-----	1,800	7,125	-----	¹ 7,000	-----
4	40-mm automatic gun, M1, on carriage, M2A1, AA.	² 3-5-----	⁴ 120	⁵ 5,500	⁵ 5,500	5,500	⁵ 5,500
5	Motor carriage, 40-mm, M19, with twin mount, M4.	-----	⁴ 240	⁵ 5,500	⁵ 5,500	5,500	⁵ 5,500
6	SP, twin 40-mm gun, T141.	-----	240	⁵ 5,500	⁵ 5,500	5,500	⁵ 5,500
7	75-mm AA gun mount, T69, with 75-mm gun, T83E1.	30-----	45	15,000	⁵ 7,200	7,000	⁵ 6,200
8	90-mm gun, M2, AA, on mount, M2, AA.	20-----	25	19,980	⁷ 12,425	13,170	⁷ 11,625
9	120-mm gun, M1, AA, on mount, M1A1, AA.	60-----	10	28,250	16,400	20,600	⁷ 16,500

¹ Maximum practical vertical range, limited by length of burning of tracer (1,800 yd).² May be fired from traveling position.³ To emplace with director—15 to 30 minutes.⁴ Manual (single shot)—60 rounds per gun per minute.⁵ For tactical planning—2,000 yd.⁶ 12-second fuse limit.⁷ 30-second fuse limit.⁸ 15-second fuse limit.(b) *Ranges of automatic weapons.*

1	2	3	4	5	6	7	8	9
Maximum deterrent slant range (yds) ¹			Maximum killing slant range (yds) ¹			Effective killing slant range (yds) ¹		
40-mm director control	40-mm M7 sight control	.50 cal MG ²	40-mm director control	40-mm M7 sight control	.50 cal MG	40-mm director control ³	40-mm M7 sight control	.50 cal MG
3,500	3,500	1,800	2,500	1,500	900	⁴ 1,500-400	⁴ 1,000-400	500-0

¹ Slant range is distance from weapon to target.² Tracer burn out range. The extent of deterrent effect of .50-caliber tracer is questionable.³ Average hit expectancy, or number of hits expected, per 100 rounds fired is 4 percent.⁴ Minimum range limited by maximum tracking rate. For targets diving directly at the gun, minimum range would be unlimited.

(3) *Field artillery barrages and concentrations.*

(a) *Barrages.* A barrage is a special type of prearranged fire placed on a line.

1	1	2	3	4		5			
	Caliber and type	Area effectively covered by one projectile ¹ (width×depth) (yds)	Radius of large fragments (yards)	Width of battery barrages (yards)		Permissible number of rounds per piece			
				Size of battery		1st ½ min	1st 4 min	1st 10 min	Prolonged fire (rds per hr)
				4-piece	6-piece				
2	75-mm howitzer.....	30×10	150	100	100	8	24	48	150
3	105-mm howitzer.....	50×15	300	100	150	4	16	30	100
4	155-mm howitzer.....	60×18	550	200	250	2	8	16	40
5	155-mm gun.....	60×18	550	(²)	-----	2	8	14	40
6	8-in howitzer or gun..	80×20	-----	(²)	-----	How Gun	6	10	30
7	240-mm howitzer.....	³ 100×25	-----	(²)	-----	-----	3	6	20
8	280-mm gun T131....	³ 200×60	-----	(²)	(⁴)	-----	1	-----	-----

¹ The area covered effectively is considered to be that area in which there is at least 50 percent chance that a man standing will become a casualty. The area is roughly elliptical.
² Not suitable for firing close to friendly troops. May be used to add depth to barrage.
³ Estimated.
⁴ Two guns per battery.

(b) *Concentrations.* A concentration is a volume of fire placed on an area within a limited time.

	1	2	3	4	5	6	7	8	9
1	Area and ammunition	Unit							Re- marks
		75-mm How Bn		105-mm How Bn		155-mm How Bn		8-in. How Bn	
		4-piece btry	6-piece btry	4-piece btry	6-piece btry	4-piece btry	6-piece btry	4-piece btry	
2	Approximate size of area covered.*	100×200	150×200	200×200	250×200	300×200	350×200	400×200	Firing with open sheaf.
3	Amount of ammunition to cover (rounds).	96	108	60	72	60	72	60	

*The area covered effectively is considered to be that in which there is at least 50 percent chance that a man standing will become a casualty. The area is roughly elliptical.

63. Characteristics of Chemical Weapons, Agents, and Munitions

a. Characteristics of Chemical Weapons.

	1	2		3	4	5	6	7	
1	Weapon	Weight		Transportation	Fuel tank capacity (gal)	Fuel consumption rate	Duration of continuous fire (sec)	Maximum effective range	
		Empty (lb)	Filled (lb)					Liquid fuel (yd)	Thickened fuel (yd)
2	Flame thrower, portable, M2A1.....	43	72	Man carried.....	5.....	½ to ¾ gal/sec.....	6 to 9.....	20.....	45.
3	Flame thrower, mechanized, M3-4-3.....	677	977	Medium tank.....	50.....	1 gal/sec.....	50.....	25 to 30....	50 to 70.
4	Flame thrower, mechanized, M6.....	693	1,013	Medium tank.....	50.....	¾ gal/sec.....	35.....	20 to 30....	40 to 60.
	¾-in. nozzle.....					1 gal/sec.....	25.....		
	¾-in. nozzle.....					1½ gal/sec.....	20.....		
5	Flame thrower, combat vehicle, main armament, M5-4.....			Medium tank.....	315.....	2.2 gal/sec.....	130.....		105.
	½-in. nozzle.....					4.4 gal/sec.....	65.....		140.
6	Generator, smoke, mechanical, M2A1.....	180	266	¼-ton truck and trailer.			Continuous.	Not appli- cable.	Not appli- cable.
	Fog oil.....				No tank.....	50 gal/hr.....			
	Water.....				6.....	5 gal/hr.....			
	Gasoline.....				6.....	5 gal/hr.....			
7	Generator, smoke, mechanical, M3.....	137	158	¼-ton truck and trailer.			Continuous.	Not appli- cable.	Not appli- cable.
	Fog oil.....					50 gal/hr.....			
	Gasoline.....					3 gal/hr.....			

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b. Characteristics of Chemical Agents.

(1) Nerve gases.

	1	2	3	4	5	6	7	8	9	10	11
1	Name	Symbol	Marking	Odor (commonly accepted)	Persistency			Classification		Effect on body	Possible methods of dispersion
					Summer	Winter	Status	Tactical	Physiological		
2	G-series.....	GB	1 green band GB GAS.	Hardly detectable, none when pure.	10 min. to 12 hr.	10 min. to 12 hr.	S	Casualty gas.	Nerve poisons.	Causes blurred vision with pinpoint pupils, skin and eye spasms, difficult breathing, tight chest, salivation, mental confusion, convulsions.	Artillery, bomb, mortar, rocket.
3	G-series.....	GA	1 green band GA GAS.	Fruity, sweetish	10 min. to 12 hr.	10 min. to 12 hr.	LS	Casualty gas.			

(2) Blood poisons.

2	Cyanogen chloride.	CK	1 green band CK GAS.	Biting.....	1-10 min...	1-10 min...	SS	Casualty gas.	Systemic poisons.	Injures lungs; causes paralysis.	Bomb, mortar, rocket grenade.
3	Hydrocyanic acid...	AC	1 green band AC GAS.	Bitter almonds..	1-10 min...	Several hours.	SS	Casualty gas.	Systemic poisons.	Injures lungs; causes paralysis.	Bomb, mortar, rocket grenade.

See footnotes at end of table.

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(3) *Blister gases.*

	1	2	3	4	5	6	7	8	9	10	11
1	Name	Symbol	Marking	Odor (commonly accepted)	Persistence			Classification		Effect on body	Possible methods of dispersion
					Summer	Winter	Status	Tactical	Physiological		
2	Mustard, distilled.	HD	2 green bands HD GAS.	Garlic or horse-radish.	3-4 days, ² 1 week. ³	Several weeks.	S	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.
3	Mustard.....	H	2 green bands H GAS.	Garlic or horse-radish.	3-4 days, ² 1 week. ³	Several weeks.	SS	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.
4	Nitrogen mustard..	HN1	2 green bands HN GAS.	Odorless to faint fishy or soft soap odor.	3-4 days, ² 1 week. ³	Several weeks.	SS	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.
5	Mustard-T mixture.	HT	2 green bands HT GAS.	Garlic or horse-radish.	More persistent than HD.	More persistent than HD.	SS	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.
6	Lewisite.....	L	2 green bands L GAS.	Irritating, sometimes like geraniums.	1 day, ² 2-3 days. ³	1 week or more.	SS	Casualty gas.	Blister gas.	Injures eyes and lungs; blisters skin.	Bomb, artillery, mortar, rocket, landmine, spray.

(4) *Choking gases.*

2	Phosgene.....	CG	1 green band CG GAS.	Fresh cut hay; ensilage.	5 min. ¹ 10 min. ²	10 min. ² 20 min. ³	S	Casualty gas.	Choking gas.	Injures lungs, causing accumulation of fluid.	Bomb, mortar, rocket.
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See footnotes at end of table.

(5) Vomiting gases.

	1	2	3	4	5	6	7	8	9	10	11
1	Name	Symbol	Marking	Odor (commonly accepted)	Persistency			Classification		Effect on body	Possible methods of dispersion
					Summer	Winter	Status	Tactical	Physiological		
2	Adamsite.....	DM	1 red band DM GAS.	Odorless or slightly like coal smoke.	1-10 min...	1-10 min...	S	Harassing gas.	Vomiting gas.	Headache, nausea, violent sneezing, coughing, temporary mental depression.	Candle, grenade.
3	Diphenyl-chloroarsine.	DA	1 red band DA GAS.	Odorless or slightly like coal smoke.	1-10 min...	1-10 min...	SS	Harassing gas.	Vomiting gas.	Headache, nausea, vomiting, sneezing.	Candle, grenade.

(6) Tear gases.

2	Chloroacetophenone.	CN	1 red band CN GAS.	Apple blossoms.	1-10 min...	1-10 min...	S	Harassing gas.	Tear gas....	Causes crying, irritates skin.	Grenade, pot.
3	CN solutions.....	CNC	1 red band CNC GAS.	Chloroform.....	1-10 min...	1-10 min...	S	Harassing gas.	Tear gas....	Causes crying, irritates skin.	Bomb, artillery, mortar, spray.
		CNS	1 red band CNS GAS.	Sweetish.....	1 min. to 1 hr.	1 min. to 1 hr.	LS	Harassing gas.	Tear gas....	Causes crying, irritates skin.	Bomb, artillery, mortar, spray.
		CNB	1 red band CNB GAS.	Benzene.....	1 min. to 1 hr.	1 min. to 1 hr.	LS	Harassing gas.	Tear gas....	Causes crying, irritates skin.	Bomb, artillery, mortar, spray.

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(7) *Screening smokes.*

2	White phosphorus.	WP	1 yellow band WP SMOKE.	Burning matches.	(1)	(1)	S	Screening smoke.	None.....	Solid particles burn skin.	Bomb, artillery, mortar, grenade, rocket.
3	Plasticized white phosphorus.	PWP	1 yellow band PWP SMOKE.	Burning matches	(1)	(1)	S	Screening smoke.	None.....	Solid particles burn skin.	Bomb, artillery, mortar, grenade, rocket.
4	Sulfur trioxide solution.	FS	1 yellow band FS SMOKE.	Acrid.....	(1)	(1)	SS	Screening smoke.	None.....	Irritates skin.....	Artillery, mortar, rocket spray.
5	Titanium tetra- chloride.	FM	1 yellow band FM SMOKE.	Acrid.....	(1)	(1)	SS	Screening smoke.	None.....	None.....	Artillery, mortar, rocket spray.
6	Hexachloroeth- ane mixture.	HC	1 yellow band HC SMOKE.	Acrid.....	(1)	(1)	S	Screening smoke.	None.....	None.....	Bomb, artillery, mortar, gre- nade, pot.
7	Fog oil ¹⁶	SGF1 SGF2	SGF OIL.....	Like petroleum oil.	(1)	(1)	S	Screening smoke.	None.....	None.....	Mechanical smoke, gener- ator.

(8) *Signaling smokes.*

2	Green smoke.....	GS	1 yellow band, color indi- cated.	Acrid.....	(1)	(1)	S	Signaling....	None.....	None.....	Artillery, bombs, grenades.
3	Red smoke.....	RS	1 yellow band, color indi- cated.	Acrid.....	(1)	(1)	S	Signaling....	None.....	None.....	Artillery, bombs, grenades.
4	Violet smoke.....	VS	1 yellow band, color indi- cated.	Acrid.....	(1)	(1)	S	Signaling....	None.....	None.....	Artillery, bombs, grenades.
5	Yellow smoke.....	YS	1 yellow band, color indi- cated.	Acrid.....	(1)	(1)	S	Signaling....	None.....	None.....	Artillery, bombs, grenades.

See footnotes at end of table.

(9) Incendiary agents.

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	1	2	3	4	5	6	7	8	9	10	11
1	Name	Symbol	Marking	Odor (commonly accepted)	Persistency			Classification		Effect on body	Possible methods of dispersion
					Summer	Winter	Status ¹	Tactical	Physiological		
2	Thermate.....	TH	1 purple band TH INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bomb grenade, equipment destroying incendiary.
3	Flare mixture.....	F8	1 purple band INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bombs.
4	Incendiary mixture.	PTI	1 purple band INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bombs.
		IM	1 purple band IM INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bombs.
5	Incendiary oil.....	NP	1 purple band NP INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bomb, flame thrower, fire starter.
		NP2	1 purple band INCEND.	None.....	None.....	None.....	SS	Incendiary..	None.....	Burns.....	Bombs.
		OT	1 purple band INCEND.	None.....	None.....	None.....	S	Incendiary..	None.....	Burns.....	Bombs.
6	Thickener, M1, M2, M3.	None	None.....	None.....	None.....	None.....	S, LS, ² SS	None.....	None.....	Burns.....	(³)

¹ S—Standard; SS—Substitute Standard; LS—Limited Standard.² In open.³ In woods.⁴ Persistency of smoke agents is subject to atmospheric conditions.⁵ SGF1 and SGF2 are summer and winter grade fog oils, respectively.⁶ Procured by CmlC; issued by QMC.⁷ Persistency of signaling smokes is subject to atmospheric conditions.⁸ Thickener M1 and M3 are standard; M2 is limited standard.⁹ Thickener, M1 (napalm), thickener, M2 (antlagglomerated napalm), and thickener, M3 (octal) are used to thicken gasoline for use in flamethrowers and bombs.

c. Data on Chemically Filled Munitions.

1	2	3	4	5	6	7
Munition	Status ¹	Agent and weight of filling (lbs unless otherwise indicated)	Weight of filled projectile (lbs unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percent) ³
<i>Grenade</i>						
2 Grenade, hand, irritant, CN-DM, M6.....	S	CN-DM.....0.64	1.06	Aprx. 1 min.....	CN-DM GAS; 1 red band....	61
3 Grenade, hand, tear, CN, M7A1.....	S	CN.....0.79	1.06	Aprx. 1 min.....	CN GAS; 1 red band.....	75
4 Grenade, band, tear, CN, M7.....	SS	CN.....0.64	1.06	Aprx. 1 min.....	CN GAS; 1 red band.....	61
5 Grenade, smoke, white, HC, AN-N8.....	S	HC.....1.2	1.6	2 to 3 minutes.....	HC SMOKE; 1 yellow band..	75
6 Grenade, incendiary, AN-M14.....	S	TH.....1.65	2	30 to 45 sec.....	TH INCEND; 1 purple band..	82
7 Grenade, band, smoke, WP, M15.....	S	WP.....0.95	1.93	Approx. 1 min.....	WP-SMOKE; 1 yellow band..	47
8 Grenade, smoke, colored, M18 (4 colors) ⁴	S	Color.....0.72	1.2	Approx. 1 min.....	1 yellow band; lettering and color of top indicate color of smoke.	60
9 Grenade, band, riot, CN, M25A1.....	S	CN.....0.2	.47	Immediately.....	1 red band on container; none on grenade.	42
10 Grenade, rifle, smoke, WP, M19A1.....	LS	WP.....0.5	1.5	Approx. 1 min.....	WP SMOKE; 1 yellow band..	33
11 Grenade, rifle, smoke, colored, M22 (4 colors) ⁴	S	Color.....0.4	1.3	Approx. 1 min.....	1 yellow band (colors indicated).	30
12 Grenade, rifle, smoke, colored streamer, M23 (4 colors) ⁴	S	Color.....0.4	.9	Approx. 12 sec. minimum.	1 yellow band (color indicated)	44
<i>Incendiaries</i>						
13 Incendiary, equipment destroying, M2A1.....	S	TH.....8.5	11.5	Approx. 1 min.....	TH; 1 purple band.....	74
14 Incendiary, safe destroying, M1A1.....	S	TH......28	32	Approx. 1 min.....	TH; 1 purple band.....	88
<i>Landmine</i>						
15 Mine, chemical, 1 gallon.....	S	HD.....99.9	12	Approx. 15 sec.....	HD GAS; 2 green bands.....	83

FOR OFFICIAL USE ONLY

	1	2	3	4	5	6	7
1	Munition	Status ¹	Agent and weight of filling (lbs unless otherwise indicated)	Weight of filled projectile (lbs unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percent) ³
	<i>Smoke pot</i>						
16	Pot, smoke, HC, M1.....	S	HC.....10.25	12	5 to 8 min.....	HC SMOKE; 1 yellow band..	84
17	Pot, smoke, floating, HC, M4A2.....	S	HC.....27	38	10 to 15 min.....	HC SMOKE; 1 yellow band..	71
18	Pot, smoke, HC, 30-lb, M5.....	S	HC.....27	33	5 to 15 min.....	HC SMOKE; 1 yellow band..	81
19	Pot, smoke, floating, SGF2, MK5 Mod 2.....	S	Fog oil.....12.5	38	8 to 13 min.....	1 yellow band.....	33
	<i>2.50-in. rocket</i>						
20	Rocket, smoke, WP, M10A4.....	S	WP.....0.89	3.4	Immediately.....	WP SMOKE; 1 yellow band..	26
	<i>7.2-in. Rocket</i>						
21	Rocket, gas, CK, M27.....	LS	CK.....18.5	51.8	Immediately.....	CK GAS; 1 green band.....	35
22	Rocket, gas, CG, M25.....	S	CG.....20.6	51.8	Immediately.....	CG GAS; 1 green band.....	39
	<i>57-mm rifle</i>						
23	Shell, smoke, WP, M308A1.....	S	WP.....0.37	2.75	Immediately.....	WP SMOKE; 1 yellow band..	13
	<i>80-mm mortar</i>						
24	Shell, smoke, WP, M302.....	S	WP.....0.75	4	Approx. 1 min.....	WP SMOKE; 1 yellow band..	18
	<i>75-mm gun</i>						
25	Shell, smoke, WP, M64.....	S	WP.....1.34	14.7	Immediately.....	WP SMOKE; 1 yellow band..	9
	<i>75-mm howitzer</i>						
26	Shell, smoke, WP, M64.....	S	WP.....1.34	14.7	Approx. 30 sec.....	WP SMOKE; 1 yellow band..	9
		SS	FS.....1.5	14.7	Approx. 30 sec.....	FS SMOKE; 1 yellow band..	10

75-mm rifle							
27	Shell, smoke, WP, M311A1.....	S	WP.....1.35	15.1	Immediately.....	WP SMOKE; 1 yellow band..	8
76-mm gun							
28	Shell, fixed, smoke, WP, M312.....	S	WP.....0.73	12.95	Immediately.....	WP SMOKE; 1 yellow band..	5
81-mm mortar							
29	Shell, smoke, WP, M57A1.....	S	WP.....4.06	12.3	Approx. 1 min.....	WP SMOKE; 1 yellow band..	33
30	Shell, smoke, FS, M57.....	SS	FS.....4.59	12.18	Approx. 1 min.....	FS SMOKE; 1 yellow band...	37
90-mm gun							
31	Shell, smoke, WP, M313.....	S	WP.....1.97	23.64	Immediately.....	WP SMOKE; 1 yellow band..	8
105-mm howitzer							
32	Shell, smoke, BE, M84.....	S	HC.....4.96	32.86	2-5 min.....	HC SMOKE; 1 yellow band..	15
			Green.....2.71	30.48	Approx. 1 min.....	1 yellow band; color indicated.	Average 9
			Violet.....2.91	30.48	Approx. 1 min.....		
			Red.....2.91	30.68	Approx. 1 min.....		
			Yellow.....2.51	30.28	Approx. 1 min.....		
33	Shell, smoke, M60.....	S	WP.....4.06	30	Immediately.....	WP SMOKE; 1 yellow band..	13
34	Shell, gas, H, M60.....	SS	FS.....4.61	30	Immediately.....	FS SMOKE; 1 yellow band...	15
			H.....3.17	30	3 to 10 days.....	H GAS; 2 green bands.....	10
105-mm rifle							
35	Shell, chemical, M325.....	SS	WP.....4.06	34.58	Immediately.....	WP SMOKE; 1 yellow band..	11
4.2-in mortar M8							
36	Shell, gas, M2.....	S	CNB.....5.45	23.1	Several hrs. to 6 days.	CNB GAS; 1 red band.....	23
			CNS.....7.0	24.6	Several hrs. to 6 days.	CNS GAS; 1 red band.....	28
			CG.....6.25	23.8	5 to 10 min.....	CG GAS; 1 green band.....	26
			CK.....5.0	22.6	5 to 10 min.....	CK GAS; 1 green band.....	21

See footnotes at end of table.

	1	2	3	4	5	6	7
1	Munition	Status ¹	Agent and weight of filling (lbs unless otherwise indicated)	Weight of filled projectile (lbs unless otherwise indicated)	Approximate time for agent to burn or evaporate at point of release ²	Marking and color	Chemical efficiency (percent) ³
			H.....6.2	23.7	3 to 10 days.....	H GAS; 2 green hands.....	26
			HD.....6.0	23.5	3 to 10 days.....	HD GAS; 2 green hands.....	25
			HT.....5.75	23.5	Longer than H or HD.....	HT GAS; 2 green hands.....	28
37	Shell, smoke, M2.....	S	WP.....7.5	25.1	About 1 min.....	WP SMOKE; 1 yellow hand.....	30
			PWP.....6.25	23.8	2 to 3 min.....	PWP SMOKE; 1 yellow hand.....	26
			FS.....7.5	25.1	Immediately.....	FS SMOKE; 1 yellow hand.....	30
			FM.....7.5	25.1	Immediately.....	FM SMOKE; 1 yellow hand.....	30
	<i>155-mm gun</i>						
38	Shell, gas, M104.....	S	H.....11.7	91.84	3 to 10 days.....	H GAS; 2 green hands.....	12
39	Shell, smoke, M104.....	S	WP.....15.6	96.24	Immediately.....	WP SMOKE; 1 yellow hand.....	16
		SS	FS.....16.9	97.34	Immediately.....	FS SMOKE; 1 yellow hand.....	17
	<i>155-mm howitzer</i>						
40	Shell, smoke, M110.....	S	WP.....15.6	95.64	Immediately.....	WP SMOKE; 1 yellow hand.....	16
		SS	FS.....16.9	99.69	Immediately.....	FS SMOKE; 1 yellow hand.....	17
41	Shell, smoke, BE, M1104.....	S	HC.....25.84	94.35	About 2 min.....	HC SMOKE; 1 yellow hand.....	20
			Colored.....18.14	⁴ 87.4	30 sec to 4 min.....	1 yellow hand; color indicated.....	20
42	Shell, gas, CNS, M110.....		CNS.....13.8	⁵ 92.8	Several hrs. to 6 days.....	CN GAS; 1 red hand.....	14
43	Shell, gas, H, M110.....	S	H.....11.7	⁵ 92.8	3 to 10 days.....	H GAS; 2 green hands.....	14
44	Starter, fire, M1.....	S	NP thickened kerosene.....0.05	.16	Approx. 13 min.....	Yellow lettering.....	31

¹ S-standard; SS-substitute standard; LS-limited standard.

² Variable, depending on the amount of agent released, type of agent, terrain, and meteorological conditions.

³ Ratio filling to total weight.

⁴ Color: red, yellow, green, violet. For air-ground and other signaling.

⁵ Estimated averages based on wide variations in zone weights.

d. *Chemical Ammunition Requirements.*

(1) *Smoke shell.*

(a) *Rounds per 100 yards per minute for combined screening and casualty effects using white phosphorus (WP).*

	1	2	3	4	5
1	Wind direction	Following 6 o'clock	Head 12 o'clock	Flank 3 or 9 o'clock	Quartering
2	81-mm mortar.....	2.5	2	1.0	2
3	4.2-inch mortar.....	1.25	1	.5	1
4	75-mm gun and bowitzer.....	12.0	10	4.0	8
5	105-mm bowitzer.....	9.0	7	1.5	6
6	155-mm bowitzer.....	3.0	2	.5	2

(b) *Rounds per 100 yards per minute for screening only.* To obtain number of rounds required, measure line to be screened in 100-yard increments. Multiply the number of increments by the quantity shown for the direction of the wind, multiply by number of minutes screen is to be maintained. Fire twice the number of rounds indicated during the first minute to establish screen.

Rounds Per 100-Yard Increments Per Minute ^{1 2 3 4}

	1	2	3	4	5
1	Wind direction	6 or 12 o'clock		3 or 9 o'clock ⁴	
		WP	HC	WP	HC
2	81-mm mortar.....	1.5	-----	0.8	-----
3	4.2-inch mortar.....	.7	-----	.4	-----
4	75-mm gun or bowitzer.....	6.0	5.0	3.0	0.5
5	105-mm howitzer.....	4.0	3.0	1.5	.25
6	155-mm gun or bowitzer.....	1.3	3.0	.5	.25
7	Smoke pots HC M-1 ⁶	-----	6.0	-----	3.0

¹ Table holds for winds up to 3 mph.

² For winds 3 mph to 10 mpb multiply above results by 1.5.

³ For winds 10 mpb to 15 mpb multiply above results by 2.

⁴ Base ejection shell should be fired with combination time and superquick fuse M-54 to give an air burst 1 to 2 seconds less than that used for zero height or burst.

⁵ Quantities are for smoke curtains up to 1,000 yards. For curtains of 1,000 to 1,200 yards, multiply values by 9; for curtains in excess of 1,200 yards, multiply values by 0.8.

⁶ For smoke pots, the quantities indicated are the number of pots that must be kept burning. The smoke pots burn an average of 7 minutes, hence the indicated quantity will screen 100 yards for that period.

(2) *Land mines, mustard (H) or lewisite (L).* Effect is obtained by contamination.

Mines Required

	1	2
1	Purpose	Mines required
2	Barriers.....	Ten parallel lines of mines 10 yards apart with mines staggered at 10-yard intervals in each line.
3	Large areas.....	40 mines uniformly spaced per 100 by 100 yard square.
4	Along roads.....	One line of mines on each side of the road with mines staggered at 10-yard intervals along each line.
5	Demolitions.....	Mines placed in lines 5 yards apart at 5-yard intervals along each line. The approaches to the demolition should be contaminated using 40 mines per 100 by 100 yard square.

e. Chemical Land Mine Operations.

	1	2	3	4	5	6
	Nature of task	Squad Task	Platoon Task	Company Task	Average time ¹	
		1 truck (2½-ton)	4 squads	12 squads	Time fuse or detonating cord	Wire for electric firing
2	Barrier..... 100 yd deep.....	300 yd wide. 300 mines....	1,300 yd wide. 1,300 mines..	5,000 yd wide. 5,000 mines...	 4 hours.....	 8 hours.
3	Road..... Contamination.....	1,600 yd. 330 mines....	6,400 yd..... 1,320 mines...	19,200 yd..... 3,960 mines...	 15 to 20 min- utes. ²	 2 hours.

¹ The time should be increased 50 percent for night work.
² Detonating cord laid from truck, mines placed on cord.

f. Capabilities of Heavy (4.2-in.) Mortar—Battalions. (Figs. are based on normal loads of ammunition of one type shell.) Firing for area neutralization using high explosive shell, white phosphorus (WP) shell, or mixed HE-WP, requires 24 rounds per square. Based on prescribed loads, a platoon can neutralize 8 squares, a company 24 squares, and a battalion 72 squares. Additional ammunition will only increase length of neutralization period.

	1	2	3	4
	Agent	Platoon	Company	Battalion
1	Nonpersistent gas.	Unit too small to use effectively.	Covers target area of 6½ squares with a surprise concentration. Gas also effective on unmasked personnel downwind on additional area at least equal to initial area covered.	Covers target area of 20 squares with surprise concentration.
2	Persistent gas...	Can contaminate 17 squares for 4 hours by firing 1 hour. ¹	3 times the capability of 1 platoon.	3 times the capability of 1 company.
3	Harassing gas (i. e., CNS).	Harasses for 4 hours 59 squares, or for 8 hours, 29 squares, etc. Gas remains effective for about 1 hour after firing ceases. The concentration should be maintained for at least 2 hours.	3 times the capability of 1 platoon.	3 times the capability of 1 company.
4	Smoke (WP)...	Can maintain 500 yd screen for 60 minutes with adverse winds. Flank winds approximately double this capability.	3 times the capability of 1 platoon.	3 times the capability of 1 company.

¹ In woods, twice as much area can be neutralized.

² Based on battalion ammunition load. Any ammunition resupply increases capability proportionately.

Section V. SIGNAL COMMUNICATION

64. General

a. These data are intended for use as general guides only. The highly technical nature of signal operations and the effect upon them of varying security measures require that these data be applied only as recommended by the unit signal officer after modification according to local field conditions and in the light of the tactical situation.

b. For signal troop requirements in a typical army, see paragraph 48k (1) and (2).

c. For signal troop requirements in airborne operations, see paragraph 50.

d. For signal construction factors, see paragraph 263.

65. Users Served by the Signal System

The following users are usually provided service over the military signal system in a theater of operations.

a. *The Combat Zone Communication System.*

(1) Division.

- (2) Corps.
- (3) Army.
- b. *Communication Zone Communication System.*
 - (1) Army group.
 - (2) Base, intermediate, and advance sections; depots and ports.
 - (3) Intratheater tactical-administrative systems.
- c. *Communication Facilities as Required for—*
 - (1) Air defense.
 - (2) Coordination of Army and Air Force activities, including facilities for the request of air support.
 - (3) Coordination of Army and Navy activities.
 - (4) Operation of military railways and pipelines.
 - (5) Military police activities, including traffic control.
 - (6) Personnel replacement systems.
 - (7) Intelligence and counterintelligence activities.
 - (8) Military government and civil affairs.
 - (9) Psychological warfare activities.
 - (10) Press, public relations, and special service activities.
 - (11) Guided missile installations and activities.
 - (12) Clandestine and guerrilla warfare.
 - (13) Interallied signal communication.
 - (14) Signal countermeasures.
 - (15) Meteorological service.
 - (16) Signal security activities.

66. Means of Signal Communication

- a. *Military Messages Are Transmitted by—*
 - (1) Messenger, including routine and special foot, motor, and airplane messengers, officer couriers, and pigeons.
 - (2) Wire circuits, including telephone, teletype, and facsimile.
 - (3) Visual, including flags, panels, lamps, and pyrotechnics.
 - (4) Sound, including whistles, sirens, bells, loud-speaker systems, and small-arms fire.
 - (5) Radio, including continuous-wave, amplitude and frequency modulated equipment, radio-teletype, and voice, in all frequency ranges, and including radio-relay equipment making up part of a wire system.
- b. *Use of the Means of Signal Communication.* Messenger, wire, and radio are used for communication between division, corps, army, and higher headquarters. In addition to these means, visual and sound systems are used in air-ground signaling, in amphibious operations, for emergency communication within small units, and as warning signals.
- c. *Publications Governing Signal Communications.*
 - (1) Pertinent sections of the unit Standing Operating Procedures

- (SOP) set forth the general principles under which the unit signal system will operate. Usually the SOP is governed by the provisions of that of the next higher headquarters and, in turn, serves as a guide for that of subordinate headquarters.
- (2) Standing Signal Instructions (SSI) are published by the unit signal officer to provide permanent directions for the use of technical items of Signal Operation Instructions.
 - (3) Signal Operation Instructions (SOI) contain the specific technical directions for the operation of the various means of signal communication. It includes separate items providing such information as telephone directory code names and numbers, radio call signs and frequencies, unit codes and ciphers, and pyrotechnic signals. Because changes in items of SOI occur frequently, paragraph 5 of the field order specifies the current index.
 - (4) Joint Army-Navy-Air Force Publications (JANAP) and Allied Communications Publications (ACP) contain joint and combined instructions and methods and procedures pertaining to communications planning and operations.

67. Command Posts and the Axis of Signal Communication

a. Axis of Signal Communication. Each Army unit is provided with sufficient signal personnel and equipment to maintain communication to next subordinate headquarters under normal tactical conditions. For the proper performance of this mission, the axis of signal communications must be so planned that when the superior headquarters moves forward, it utilizes the wire circuits previously laid to the headquarters of a major subordinate unit.

b. Command Posts. Each army unit is provided with sufficient signal personnel and equipment for an adequate service within all echelons of the unit headquarters. The time required to complete the signal installation varies with the type and size of the headquarters. The following table provides data for a complete installation of the types of headquarters indicated and includes the time required for reconnaissance, completing the initial forward installation, closing out the rear installation, moving all equipment forward, and completing the forward installation. Essential facilities for the commander and general staff will be complete within approximately one-quarter of the total time.

	Division	Corps	Army	Army Group
Time required to complete the installation of signal facilities within a headquarters (WW II, ETO).	1 day.....	2 days.....	4 days.....	As determined by available troops

c. Movement. Because each movement results in a temporary curtailment in operating facilities and because frequent movement results in decreased operating efficiency, command posts are moved as infrequently as the tactical situation allows. When it is necessary for the commander to maintain a headquarters close to the front in a rapidly moving situation, arrangements are made to provide minimum facilities for the Commander's Group. The following table represents an average of moves computed from After Action Reports from the European Theater for the month of April 1945: it represents a maximum figure at which operating efficiency was decreasing.

	Division	Corps	Army
Average movement of command post per month.....	11	7	2

68. Messenger

a. The rate of travel of various types of messenger is listed below; no consideration being given to traffic restrictions, climate, or weather:

Kind of messenger	Rate of travel in miles per hour	
	Day	Night
Dismounted (runner).....	3-5	2-4
Bicycle.....	6-10	4-8
Motor or motorcycle.....	25-40	15-30
Pigeon.....	30-45	.....
Aircraft.....	80 upwards	80 upwards

b. Each headquarters is furnished organic messenger facilities. The bulk of messenger traffic is carried by motor messenger. The capabilities of motor messenger service available to units is indicated below.

	Division	Corps	Army
Miles of route per month.....	7,000	30,000	90,000
Pouches and messages.....	17,000	50,000	150,000

c. The quantity of messages that can be transmitted by messenger and the speed of transmission are increased when messages are accounted for in the communication center by pouch instead of by individual message.

69. Wire

a. General. Wire communication networks are classified as approved or nonapproved circuits according to the degree of transmission security they afford against enemy tapping and interception. Relative security depends upon geographic location of the net, the tactical situation, local security measures, the type of equipment being used, and the type of conductor employed in the lines. Lines that possess a high degree of security may be classified as approved circuits for the transmission of restricted, confidential, or secret material in the clear. Lines that possess a low security rating require that all classified messages transmitted over them be encrypted in an appropriate system and are classified as nonapproved circuits.

b. Telephone. Each headquarters is provided with enough telephone facilities to satisfy normal operating requirements, provided that proper use is made of written messages for traffic not adapted to telephonic transmission. During World War II, unit switchboards in the European Theater handled the following average of calls:

	Division	Corps	Army	Army group
Calls per day.....	2,000	5,000	12,500	18,000

c. Teletype. The following table shows the average number of teletype messages handled by various types of headquarters in the ETO during World War II.

	Division	Corps	Army	Army group
Messages per month.....	750	4,000	11,500	28,000

d. Construction. For figures on permanent and semipermanent wire construction consult paragraph 263.

(1) Rates of wire line construction.

	Foot troops	Reel trucks	Signal Construction Battalion
Field wire.....	1½ mph/3-man team.	3-5 mph/6-man team.	
Spiral-4 cable (on existing support).....		1 mph/8-man team.	
Open wire (10-wire pole line).....			30 miles per week.

(2) *S-4 cable and field wire laid to next subordinate headquarters by selected units during World War II in the ETO.*

Miles per month of—	Division	Corps	Army
Field wire.....	450		
Cable and field wire.....		700	1,300
Open wire.....			500

(3) *Average rate of repair of wire lines over a 6-month period during World War II in the ETO by a well-trained division signal company.*

	Daylight	Night	Average time out day and night
Elapsed time in minutes.....	70	120	105

70. Radio

a. *General.* The amount of traffic that is handled by radio—exclusive of messages handled via radio-relay equipment installed as part of the wire net—depends upon the type of unit and the rate of displacement. In general, radio forms a stand-by means of communication during static conditions when its operation would provide information to enemy intercept and analysis; but in fast-moving situations when it is difficult to extend wire lines rapidly enough and when units disperse on a wide front, radio becomes a major means of communication.

b. *Radio Traffic of Selected units in the ETO During World War II.*

	Armored Division	Infantry Division	Corps	Army	Army group
Average messages per month.....	2,400	200	500	9,500	3,800
Average code groups or words per month.....		35,000	85,000	163,000	650,000

71. Communication Center

a. *Function.* It is the function of the communication center to determine the most expeditious means of transmitting written messages and to operate the centralized transmission facilities. The figures in paragraphs 69c and 70b therefore apply to communication center operations.

b. Cryptographic Operations. Computed from After Action Reports of selected units in the ETO during World War II, and including messages sent by radio, teletype and miscellaneous means.

	Division	Corps	Army	Army groups
Average code groups per month.....	225, 000	500, 000	750, 000	1, 800, 000

c. Precedence. The nomenclature for classes of precedence in the following table, compile from After Action Reports in the ETO during World War II, has been changed to conform to present usage.

	Emergency	Operational immediate	Priority	Routine	Deferred
	Percent	Percent	Percent	Percent	
Percentage of all messages (Army Hq).....	8	30	23	39	Negligible.

d. Speed of Transmission. Computed to allow for operational signaling, repeating garbled groups, including address and signature, and receipting.

Means of transmission	Words per hour
Radiotelephone.....	80-120
Lamp.....	100
Telephone.....	100-150
Panel (code groups per hour).....	15
Radiotelegraph.....	150-250
Teletypewriter (single line).....	500-800
Teletypewriter (duplex).....	1, 000-1, 500

Section VI. FIELD ENGINEERING

72. General

These data are intended for use as general guides only. Their application should be varied to conform to local field conditions as required in each specific tactical situation, based on the recommendation, after reconnaissance, of the unit engineer charged with the task.

73. Roads and Bridges

a. Traffic Capacity. See chapter 7.

b. Load Capacity of Civilian Bridges. Peacetime design includes high safety factors for unusual loads and deterioration. As a guide for military operations, it may be assumed that the ordinary civilian

bridge in good condition will carry twice the rated civilian capacity where restrictions are placed on the speed and spacing of vehicles and on the number of lanes in use. However, it is advisable to have bridge capacity analyzed by an engineer officer.

c. Road Capacity. The capacity of a road is limited usually by the capacity of the bridges thereon.

d. Marking Bridges and Vehicles.

- (1) Bridges are marked with class and width numbers. The bridge class number is the whole number which represents the safe load-carrying capacity in tons of the bridge under normal conditions. The bridge width number is the clear width in inches between curbs, without regard to lanes. Bridges are marked or posted to the next lower whole number up to class 30, and to the next lower multiple of 5 for classes above 30; for example: the actual class number of a bridge theoretically classified as 21.75 would be 21, and class numbers for bridges theoretically classified as 32, 53, and 79 would be 30, 50, and 75, respectively. Bridge signs are circular in shape and show class and width numbers; the class numerals are twice the size, and are shown above, the width numerals. In addition, a rectangular sign is placed below the circular sign, stating the length of the critical span of the bridge or showing that the structure is a floating bridge.
- (2) Vehicles are marked with class numbers and with front width and side width numbers. The vehicle class number is the whole number which represents the effect a vehicle will have on a bridge in crossing it; the effect is determined from the gross weight of the vehicle and the weight distribution. The front vehicle width is the overall width of the vehicle in inches, plus 12. The side vehicle width number is the out-to-out tire or track width of the vehicle in inches. All standard Army vehicles are classified except trailers with a gross weight of less than one ton and other types of vehicles with a gross weight of less than 3 tons. All *single* vehicles in excess of 3 tons gross weight, carry front and side signs; all *trailers* in excess of one ton gross weight, carry a side sign. The front sign shows the class number over the front width number, while the side sign shows the class number over the side width number. The front sign of a *combination* vehicle shows the class and front width numbers of the combination, with the letter "C" above the class number. The side signs of combinations show the class and side width numbers of each part of the combination. A *towed vehicle and its tower* are considered to be separate vehicles unless both are in a

given span at the same time and the distance between the two is less than 30 yards, in which case they are considered to be a combination vehicle. When considered as a combination vehicle, the class of the combination is the sum of the classes of the separate vehicles, and is shown on a temporary front sign, together with the front width number of the wider vehicle. Detailed information is contained in FM 5-36.

74. River Crossing Equipment

a. Distribution of Floating Equipment.

1	2	3	4	5	6
Item	Engr O Bn Div	Armd Engr Bn	Abn Engr Bn	Engr Pon Brg Co	Engr Float Brg Co
2 Boat, assault, M2.....	16	42	28		70
3 Boat, recon, pneumatic, 2-man.....	18	18	15		
4 Boat, recon, pneumatic, 5-man.....				1	1
5 Boat, utility, powered, 19-ft.....				1	
6 Boat, utility, powered, 27-ft.....		2	1	3	1
7 Bridge fixed and floating, airborne division, 50-ton (276 ft 8 in.).....			1		
8 Bridge, floating, M4 (428 ft).....				1	
9 Footbridge, M1938 (432 ft)*.....					
10 Ferry set No. 1, infantry support*.....					
11 Boat, storm.....					
12 Bridge, Floating, pneumatic float, class C0, steel superstructure (600 ft).....					
13 Raft, infantry support.....	2		2		
14 Bridge, floating, treadway, steel, widened (288 ft).....		2			
15 Bridge, fixed, steel, widened for short spans (216 ft).....	1				

*Available in Army Engr CI II and IV Dep.

b. Characteristics of Boats and Rafts.

(1) Assault and storm boats.

1	Boats	Engr crew, number of men	Various maximum loads per boat, in addition to crew	Maximum stream velocity fps	Time in min for round trip across stream with width of		
					300 ft.	500 ft.	1,000 ft.
2	Single assault boat M2 w/9 paddles.	3	12 riflemen with ind equip.....	4	4	6	10
3			1 rifle sqd.....				
4			1 hv MG sqd w/gun and 13 boxes ammo....				
5			1 81 mm mortar sqd w/mortar and 50 rounds ammo.				
6			2 LMG sqds w/guns and 20 boxes ammo....				
7			2 60 mm mortar sqds w/mortars and 72 rounds ammo.				
8			1 75 mm rifle sqd w/rifle and 70 rounds ammo.				
9			1 57 mm rifle sqd w/rifle and 100 rounds ammo.				
10	2-assault boat ponton w/out board motor.	2	22 riflemen with ind equip.....	7	4	6	
11			15 riflemen with ind equip.....	9			
12	Storm boat.	2	7 riflemen with ind equip.....	11	3	4	
13			1 hv MG sqd w/gun and 9 boxes ammo....				
14			1 81 mm mortar sqd w/mortar and 24 rounds ammo.				
15			1 LMG sqd, 2 extra men, gun and 10 boxes ammo.				
16			1 60 mm mortar sqd, 2 extra men, gun, and 36 rounds ammo.				

(2) Rafts.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
1	Type of raft	Number of pontoons or floats	Length		Construction time ^b	Construction party	Operating crew	Class and number of power units needed ^a								Type of power unit required	Transportation required (for raft equipment only. Additional needed for construction equipment and troops)			
			Overall incl ramps	Available for loading ^a				Normal crossing				Risk crossing								
								Stream velocity FPS				Stream velocity FPS								
								3	5	7	9	3	5	7	9		Number of units	Unit		
2	Infantry support.	3	38'-0"	24'-0"	10 min.	1 plat...	1 sqd...	1 8	2 8	3 4	-----	1 10	2 9	3 5	4 2	Outboard motors.			1	2½T truck w/ polo tlr.
		5	50'-0"	35'-9"	15 min.			1 13	2 10	3 5	-----	1 15	2 13	3 8	4 3				2	2½T truck w/ pole tlr.
		7	62'-0"	47'-9"	20 min.			1 13	2 13	3 8	4 -----	1 16	2 15	3 10	4 5		3	5T bridge trucks.		
4	Widened steel treadway.	4	64'-11¼"	42'-0"	30 min.	1 plat...	1 sqd...	1 35	1 35	1 35	2 20	1 45	1 35	1 40	2 25	27' bridge erection boats.*	3			
6		5	76'-11¼"	48'-3"	45 min.			1 45	1 45	1 45	2 25	1 50	1 50	1 50	2 30					
7	M4	4				1 plat...	1 sqd...	1 55	1 55	1 55	2 55	1 60	1 60	1 60	2 60	27' bridge erection boats.*	5	5T DP trucks.		
8		6	87'-¾"	51'-8"	1 hr....			1 75	1 75	1 75	2 70	1 80	1 80	1 80	2 80		6			
9		7						1 90	1 90	1 90	2 85	1 95	1 95	1 95	2 95		7			
10	Airborne division 50-ton.	4	87'-¾"	51'-8"	1 hr....	1 plat...	1 sqd...	1 35	1 35	1 30	2 20	1 45	1 45	2 40	3 25	27' bridge erection boats.*	4	5T bridge trucks.		
11		6	88'-8¾"	53'-4"	1½....			1 55	1 60	2 45	-----	1 65	1 60	2 50	3 15		5			

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Key

Number of power units needed
Capacity in tons (one or more
vehicles)

Key

Number of power units needed
Single vehicle capacity in tons
Double vehicle capacity in tons
(Vehicles should be approximately
equal in weight)

	1	2	3	4
1	Operating characteristics of rafts	Stream width feet		
		300	500	1,000
2	Number of round trips per hr in currents of 5 FPS in daylight (reduce 50% for night or adverse conditions).....	10	6	4
3	Number of rafts which can be used efficiently at one site.....	1	2	3

a Measured from outside edge to outside edge of end pontoons or floats.

b Construction time includes unloading and construction only, does not include preparation of landing sites or construction of access roads.

c Capacities are based on loading rafts with center of gravity of loads 6' downstream from • of raft and on properly inflated floats.

d One 19' bridge erection boat per raft, in current of 9 FPS.

e One 19' bridge erection boat may be used in currents not over 5 FPS. In currents of 5 FPS and over, normally two 19' bridge erection boats may be substituted for one 27' boat.

Extreme caution is required in loading and unloading vehicles weighing more than 70 tons.

Note.—The 19- and 27-foot bridge erection boats replace the 18- and 25-foot utility boats.

c. Characteristics of Standard Floating Bridges.

	1		2		3	4	5	6	7		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
1	Type of bridge		Transportation required ¹		Construction time in hours ²				Construction party ³	Maintenance crew	Capacity in tons ⁴												Traffic capacity and vehicular distance for safe crossings in daylight (except as otherwise noted) ⁵						
					Stream widths						Safe crossing ⁶ (posted capacity)			Caution crossing ⁶			Risk crossing ⁷												
											Stream velocities in feet per second																		
											150 ft.	250 ft.	500 ft.	1,000 ft.	3	5	7	9	11	3	5	7		9	11	3	5	7	9	11
2	Foot-bridge M1938 (432 ft.).		1—2½t truck per 144 ft. of bridge.		$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$		1 Plat.....	1 Sqd....	Safe.....			Un-safe															Day: 75 men per minute. Night: 40 men per minute at normal 2-pace distance. ¹⁰
	3	M2 Assault Boat Bridge	Normal construction.	1—2½t truck and 1 polo tlr per 36 ft of bridge.	1	1½	2½		1 Plat.....	1 Sqd....	8	6	5			8	6	5					9	7	6				200 vehicles per hour; 90-ft. distance between vehicles.
4			Reinforced construction.	1—2½t truck and 1 polo tlr per 24 ft. of bridge.	1½	2	3		1 Plat.....	1 Sqd....	13	9	7			13	11	8					14	12	9				
5	Widened steel treadway bridge.		1—5 ton Brg truck per 24 ft. of bridge.		2½	4	7	12	1 float br co plus 1 combat co.	1 Sqd....	50	50	40	30	15	50	50	45	35	20	55	55	50	45	30				

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					
1	Type of bridge	Transportation required ¹	Construction time in hours ²				Construction party ³	Maintenance crew	Capacity in tons ⁴															Traffic capacity and vehicular distance for safe crossings in daylight (except as otherwise noted) ⁵					
			Stream widths						Safe crossing ⁶ (posted capacity)			Caution crossing ⁶			Risk crossing ⁷			Stream velocities in feet per second											
			150 ft.	250 ft.	500 ft.	1,000 ft.			3	5	7	9	11	3	5	7	9	11	3	5	7	9	11						
6	M4 bridge.....	1—5 ton Dump truck per 15 ft. of bridge (normal const.).	3	5	8	14	1 ponton br co plus 1 or 2 combat cos.	1 Sqd...	55 95	55 95	55 95	45 70	30 40	60 100	60 100	50 85	40 55	65 105	65 105	65 105	55 100	45 70		400 vehicles per hour; 90 ft. distance between vehicles.					
7	Airborne division, 50 ton. ¹¹	5—5 ton Bridge trucks per 60 ft. of bridge.	4	6	-----	-----	1 br plat plus 1 combat co.	1 Sqd...	45	35	30	10	---	50	40	35	15	---	55	50	45	25	---						
8	Class 60 floating bridge.	1—5 ton Bridge truck per 15 ft. of bridge.	1½	2½	4½	8½	1 brg plat, plus 1 combat plat.	1 Sqd...	60	60	55	50	18	65	65	60	55	30	75	75	70	65	45						

¹ Transportation for bridge equipment only. Additional needed for any construction equipment required, and for troops.

² Includes unloading and construction only in daylight. Does not include access roads, assembly sites, abutments or anchorages.

³ Average for trained troops and continuous daylight construction. Allowances are required for specific situations.

⁴ Based on abutments at levels within 12 inches of floating bridge deck level.

⁵ Vehicle anywhere on width of bridge deck. Speeds—15 mph recommended, up to 25 mph permitted.

⁶ Center of vehicle on bridge centerline. Maximum speed 8 mph. Vehicle spacing 150 ft. No sudden stopping or acceleration, or gear shifting.

⁷ Center of vehicle within 9" of centerline and with guide. Maximum speed 3 mph One vehicle on bridge. No stopping, braking or gear shifting.

⁸ Traffic capacities are for all traffic moving forward or rearward.

⁹ Normal construction

Reinforced construction

¹⁰ Use 2-pace distance for 3 fps only; 1-bay distance for 4 and 5 fps; 2-bay distance for 6 and 7 fps.

¹¹ These classes do not govern the crossing of M4A3, M16, M45, and M46 tanks. These tanks can make normal crossings on the M4A2 bridge for current velocities up to 5 fps even though their class numbers exceed 35. These exceptions do not apply to other bridges or to other vehicles whose class numbers are greater than 35.

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	1	2		3								4	5	6
1		Fixed panel bridge		Panel bridge Bailey type, M2								Semipermanent steel fixed-bridges ^{1 2}		
2	Length of one unit			130 feet (double-double)								30-foot I-beam span	60-foot I-beam span	90-foot truss span
3	Posted capacity in tons	Span (ft)	Type T6, width 13'6"	Span (ft)	Type									
			Single truss		Double truss	Single-single	Double-single	Triple-single	Double-double	Triple-double	Double-triple			
			Tons	Tons		Tons	Tons	Tons	Tons	Tons	Tons			
	120				30	40								
					40	32								
					50	28	80							
	135	60			60	26	67							
					70	22	64							
	165				80	18	51	80				50 tons	60 tons	50 tons
					90	13	44	62						
	195		60		100	10	31	52	75					
					110		23	40	64	80				
					120		18	34	50	50				
					130		13	23	40	57	80			
					140		10	18	31	48	67			
					150			13	23	40	65			
					160			10	19	31	56	80		
					170				13	23	50	70		
					180				10	18	40	57		
					190					12	31	50		
					200						23	40		
					210						18	29		

	1	2		3								4	5	6	
1		Fixed panel bridge		Panel bridge Bailey type, M2								Semipermanent steel fixed-bridges ^{1 2}			
2	Length of one unit			130 feet (double-double)								30-foot I-beam span	60-foot I-beam span	90-foot truss span	
3	Posted capacity in tons	Span (ft)	Type T6, width 13'6"		Span (ft)	Type									
			Single truss	Double truss		Single-single	Double-single	Triple-single	Double-double	Triple-double	Double-triple				Triple-triple
4	Packaged weight of unit in short tons. ²		Tons	Tons		Tons	Tons	Tons	Tons	Tons	Tons	100	Steel 6.5..... Lumber 6.4....	Steel 22.9..... Lumber 12.4...	Steel 31.0. Lumber 18.9.
5	Packaged cubage of one unit in sbip tons. ³											145	Steel 7.5..... Lumber 8.0....	Steel 20.3..... Lumber 15.7...	Steel 48.6. Lumber 22.1.
6	Issue.....	Class IV restricted issue.		Class IV, 42 2½-ton trucks.....								Class IV restricted issue.			
7	Transportation for one unit.											2 8-ton full flat bed trailers w/prime movers 450.	4 8-ton full flat bed trailers w/prime movers 1,000.	7 8-ton full flat bed trailers w/prime movers 2,000.	
8	Man-hrs per unit. ⁴											600			

¹ This equipment is not standardized and has been declared excess; however, specifications are being maintained.

² With one line of traffic.

³ Values are approximate only and are subject to change due to revised packaging and changes in components of sets.

⁴ Does not include time for preparation of approach roads, assembly sites, and elaborate abutments. Adjustments must be made for specific site conditions.

e. Railway Bridging Equipment.*

	1	2	3		4		5	6	7				
		I-beam railway bridge	Unit construction railway bridge		Through truss railway bridge		Light standard (L-type) unit steel trestle	Standard (T-type) unit steel trestle	V-type unit steel trestle				
1													
2	Unit.....	Spans: 17, 21, 27, 31, and 35 feet.	70-foot 2-girder deck and through spans ¹		123-foot span ¹		None. Ordered by parts as required.	None. Ordered by parts as required.	None. Ordered by parts as required.				
3	Use.....	Spans: 17 to 35 feet.....	Spans: 50 to 85 feet.....		Spans: 90 to 150 feet.....		Piers for I-beam and unit construction bridges.	Piers for through truss bridge.	Marino piers, quay repairs, and railway viaducts.				
4	Capacity ²	E-45 loading.....	E-45 loading.....		E-45 loading.....		E-45 loading.....	E-45 loading.....	45 tons E-35 loading.				
5	Issue.....	Class IV restricted issue.	Class IV restricted issue.		Class IV restricted.....		Restricted issue.....	Restricted issue.....	Restricted issue.				
			70-foot deck span	70-foot through span	120-foot span	150-foot span							
6	Man-hours ³	400-600.....	1,300	1,500	8,000	10,000	No data ¹	No data ¹	12 per ton using power crane. ⁴ 17 per ton using hand cranes. ⁴				
		Span (feet)											
		17	21	27	31	35							
7	Shipping weight (short tons).	3.1	5.0	6.9	10.0	13.2	35.6	49.8	140	173	Varies with type of pier. See TM 5-374		Steel: $W_s=0.2 \text{ HN}^6$ Decking and fendering: $W_L=1.5 \text{ M}$
8	Cubage (ship tons).....	3.2	3.6	4.8	7.9	8.0	22.5	32.5	140	171	$C_s=0.7 W_s^4$	$C_s=0.5 W_s^4$	Steel: $C_s=0.7 W_s^6$ Decking and fendering: $C_L=1.6 \text{ M}$

See footnotes on p. 186.

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¹ Sets also are provided for conversion to other spans and types of construction. Erection equipment is ordered separately. See TB ENG 12 and TB ENG 56.

² Maximum speed is 40 mph. This must be reduced on 130- to 150-foot through truss spans. See TM 5-372.

³ Tentative. Value is from arrival of equipment on the site and includes unloading and construction in daylight and laying of track. For night, increase 50 percent. Time for erection of piers, approaches, and approach spans is not included. No data are available on V-trestle railway viaducts.

* Data are based on information available 1 August 1947.

⁴ Value is based on favorable conditions and experienced crew, and does not include preparation of foundations.

⁵ Formulas for typical V- and T-shaped piers are approximate only.

⁶ The 8,000 and 10,000 man-hours, in column 4 covers superstructure only including placing ties. Estimate 37 man-hours per short ton for erection of this type structure.

⁷ Estimate 30 man-hours per short ton as an overall average.

75. Explosives

	<i>Unit</i>	<i>Pounds</i>
	Engineer Battalion (C) (Division)	12, 570
	Engineer Battalion (C) (Army)	10, 800
	Headquarters & Service Company	(5, 450)
	Lettered Company (ea)	(1, 780)
	Armored Engineer Battalion	9, 840
	Lettered Company (ea)	(1, 710)
	Airborne Engineer Battalion	12, 754
	Headquarters & Service Company	(4, 996)
	Lettered Company (ea)	(2, 586)
	Headquarters & Headquarters Company, Infantry Battalion	50
	Reconnaissance Company (Division)	300

76. Field Fortifications

a. Priority of Work. The order in which the various defensive measures are to be executed is expressed in orders in the form of priorities. The assignment of priorities does not prevent simultaneous work on several tasks. After the location of combat emplacements has been fixed, the normal priority is—

- (1) Clearing fields of fire and removal of objects masking observation.
- (2) Laying of antitank mine fields and execution of important demolitions such as bridges.
- (3) Providing for adequate signal communication and observation systems.
- (4) Preparing individual shelter and emplacement of weapons.
- (5) Preparing obstacles (other than mine fields) and other demolitions.
- (6) Preparing routes for movement of reserves and for supply and evacuation.

b. Works (Figs. are for daylight; for work at night, increase labor by 50 percent).

(1) *Time and labor for constructing entrenchments.*

	1	2	3	4
1	Type of emplacement	Excavation (cu ft)	Number of men working	Approximate time (hrs)
2	Shallow connecting trench (10-yard section)	150	6	1
3	Standard trench (10-yard section with one firing position)	515	6	6½
4	Special trench for artillery or rear-area installations (2-yard section)	48	1	2½
5	Prone shelter	24	1	1
6	1-man fox hole	35	1	1½
7	2-man fox hole	60	2	2½
8	3-man V-shaped fox hole	189	3	5
9	3-man Y-shaped fox hole	237	3	6

(2) *Revetment estimates.*

1	1		2	3
	Type		Quantity of material necessary	Time for construction (man-hours)
2	Sandbag----	Single row of stretchers for small revetments.	160 sandbags per 100 sq ft of surface reveted.	16 per 100 sq ft (includes time for filling bags).*
		Alternate headers and stretchers.	320 sandbags per 100 sq ft of surface reveted.	32 per 100 sq ft (includes time for filling bags).*
		Fills, parapets, and breastworks.	195 sandbags per 100 cu ft of fill-----	20 per 100 cu ft (includes time for filling bags).*
3	Issue material.	Burlap, wire mesh, wire, and pickets.	Burlap—100% of area to be reveted----- Pickets: Soft soil—1 every 1½ ft. Hard soil—1 every 6 ft. Wire—20 ft for every picket.	2 per sq ft.
4	Natural material.	Brush, wire, and pickets.	Wire mesh—100% of area to be reveted. Brush—Dependent upon nature of foliage or brush. Pickets: Soft soil—1 every 1½ ft. Hard soil—1 every 6 ft. Wire—20 ft for every picket	8 per 100 sq ft.

*Does not include carry of more than 50 ft.

(3) *Clearing.* Four man-hours of labor are required for clearing 100 square yards of brush and a few trees up to 12 inches in diameter; for brush only, 2 man-hours.

(4) *Excavation and camouflage data for emplacements.*

1	1	2	3	4	5
	Weapon	Type of emplacement	Area to be camouflaged (ft)	Excavation (cu ft)	Man hours required to construct in medium soil
2	Rifle-----	Fox hole-----	10×10	37	1½
3	Automatic rifle-----	Fox hole-----	10×10	37	1½
		Pit-fox hole---	10×10	125	1
4	Rocket launcher-----	Pit-----	5×5	287	4½
		Horseshoe-----	15×15	50	3
5	Machine gun, light cal .30-----	2-fox hole-----	12×12	123	7
		Horseshoe-----	15×18	74	3
6	Machine gun, heavy cal .30-----	3-fox hole-----	15×15	140	8
		Pit-----	14×14	111	5
7	60-mm mortar-----	Pit-----	16×16	70	4
8	81-mm mortar-----	Horseshoe-----	12×15	108	6
9	57-mm recoilless rifle-----	Horseshoe-----	16×16	125	6¼
10	75-mm recoilless rifle-----	Circular-----	29×29	150	7½
11	105-mm howitzer M3-----			430	22

1 Without fox holes.

2 With fox holes.

(5) *Barbed-wire obstacles.*

(a) *Estimating requirements.* The minimum length of tactical wire entanglements for a defensive position is one and one-quarter times the frontage; minimum protective wire is five times the frontage. The length of tactical wire entanglements for a deliberate defense is five times the frontage; protective wire is six times the frontage.

(b) *Wire entanglement materials for 300 yards of entanglement.*

	1	2	3	4	5	6	7	8	9	10
1	Type of entanglement	Pickets				Barbed wire 400 yd 115 lb reels ¹	Con- cer- tinas	Staples made of 1/4" round drift pins	Lbs of mate- rials per lin yd of en- tangle- ment ²	Man hours to erect 300 yds of en- tangle- ment ³
2	Double-apron, 4- and 2- pace.....		91		182	12-13			10	54
3	Double-apron, 6- and 3- pace.....		61		122	11-12			7	45
4	High-wire (less guy wires).....		181			15-18			12	72
5	Low-wire, 4- and 2-pace.....			91	182	9			7.5	45
6	Four-strand fence.....		91		2	3 1/2-4			4	18
7	Double-belt expedient concertina.....		92		4	2	4 90	270	14	36
8	Triple-belt expedient concertina pyra- mided).....	46	92		6	3	4 135	270	21	90
9	Triple-belt standard Dannert concertina.....		146		4	2	54		15	27

¹ Lower number of reels applies when screw pickets are used; higher number when U-shaped pickets are used. Add difference between these 2 to the larger number when wood pickets are used.

² Average weight when any issue metal pickets are used.

³ With exception of triple-belt concertina, man-hours are based on use of screw pickets. When driven pickets are used, add 20 percent to man-hours. With experienced troops, reduce man-hours by one-third. Increase man-hours by 50 percent for night work.

⁴ Based on concertinas being made up in rear areas and ready for issue. One expedient concertina opens to 20-foot length (as compared with 50 feet for a commercially made Dannert concertina) and requires 100 yards of stranded barbed-wire, also small quantities of No. 13 and No. 16 smooth wire for ties.

(c) *Wire materials for making expedient concertinas for 300 yards of entanglement.*

Type of concertina	Standard barbed-wire 400-yd reels	No. 10 wire 100-lb. coils	No. 16 wire 10-lb. coils
Double-belt.....	23	1	1
Triple-belt.....	34	1	1

77. Mine Fields.

For data pertaining to mine fields, see FM 20-32.

78. Fordable Depth of Water *

Type unit	Depth (ft.)
Infantry on foot.....	3½
Horse cavalry.....	4½
Trucks and truck-drawn artillery.....	12
Light tanks.....	11-3
Medium tanks.....	12-4
Heavy tanks.....	14-6

* May be materially increased by suitable waterproofing. For streams of high current velocity, the attitude of the tank to the current has an appreciable effect on the depth which may be forded. The length of time the tank is exposed to the current also has an appreciable effect. Forty-eight inches is the design fording depth of modern US tanks. Experience indicates that tanks can ford slightly greater depths for short distances without going out of action.

79. Load Bearing Capacity of Ice.

The strength of ice varies with the structure of the ice; the purity of the water from which it is formed; the cycle of formation, or freezing, thawing, and refreezing; temperature, snow cover; and water currents. The sustaining capacity of ice is not definitely determined but experience and tests provide working-capacity figures for good quality ice of varying thicknesses as given in the table below.

Load	Minimum thickness of ice (in.)	Minimum interval between tracks, or distance between elements (ft)
Single rifleman on skis or snowshoes.....	1½	16
Infantry columns, single horses, motorcycles, unloaded sleds.....	4	33
Single light-artillery piece, ¼-ton truck, 4 x 4.....	6	49
Light artillery, passenger cars, medium ½-ton trucks, light total load of 3 tons.....	8	65
2½-ton trucks, light loads.....	10	82
Closed columns of all arms except armored force and heavy artillery.....	12	98
Armored scout cars, light tanks.....	14	115
20-ton vehicles.....	16	131

*Moderate current, hard bottom.

CHAPTER 5

LOGISTICS—SUPPLY

Section 1. GENERAL

80. Use of Logistical Data

The logistical data contained in this and the succeeding four chapters (Logistics—Evacuation and Hospitalization; Logistics—Transportation; Logistics—Service; Logistics—Management) are of the type suitable for first approximation planning. They are, in the most part, based on World War II experience, modified to reflect changes in concept and organization. Detailed logistical planning should be based upon the references listed in the foreword.

81. General Supply Factors

a. The following broad general factors are useful for very long-range planning where the figures in the balance of this chapter are too detailed. They should be used only in forming rough estimates in logistical planning or as “rule of thumb” checks against the calculations of technical planners. The overall theater factors given below include only military requirements and are based on the following ratios between ground and air: For each division slice of 40,000 men there will be two air wing slices of 5,000 men each (see par. 124a).

b. Initial Equipment and Initial 30 Days of Maintenance.¹

1	2	3	4	5	6	7	8	9
	Total requirement per man in the theater (Army plus Air) ¹			Shipped from ZI ²			Procured in TOPNS ³	
	Measure tons per man	Short tons per man	Long tons per man	Measure tons per man	Short tons per man	Long tons per man	Short tons per man	Long tons per man
2	4.0	1.50	1.33	4.0	1.50	1.33	-----	-----
3	1.0	.68	.60	.8	.54	.48	.14	.12
4	.4	.23	.25	.4	.23	.25	-----	-----
5	5.4	2.46	2.18	5.2	2.32	2.06	.14	.12

¹ For use as broad initial planning factors. Does not include tonnages involved in buildup of theater reserves.

² Applicable only in situations where procurement in the theater of operations is feasible.

³ Bulk petroleum normally is not expressed in measurement tons. This figure is provided in this table merely for the purpose of comparison with dry cargo.

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Section II. CLASS I SUPPLY

82. Characteristics of Standard Rations

1	2	3	4	5	6	7
1	Packaging Information			Average weight per ration including packing (lb.)	Average weight per ration unpacked (food only) (lb.)	Remarks
	Type ration	Number rations per package (case)	Weight per package (lb.) (case)	Volume per package (cu. ft.) (case)		
2	Field, Type A.....			6.0	5.2	This is the basic field ration. Components, weight, and volume vary. Normally contains maximum of fresh meat, dairy products, fruits, and vegetables, and other perishables (0.183 cu. ft. per ration).
3	Operational, Type B.....			5.3	4.3	Same as field ration with nonperishable items substituted for perishable (0.1269 cu. ft. per ration).
4	Same Dct, Type "5 in 1".....	5.....	27	0.8	5.8	3.7 Nonperishable precooked or prepared food which may be eaten hot or cold. Five separate menus.
5	Individual combat, Type C-4.....	6.....	40.0	1.1	6.6	4.1 Nonperishable precooked or prepared food which may be eaten hot or cold. Recommended duration of use: 2 days maximum. Five separate menus.
6	Food packet, individual assault.....	24 packets.....	39	1.3	1.5	1.25 Nonperishable precooked or prepared food which may be eaten hot or cold. Packaged so as to be carried by the individual. Recommended duration of use: 1 day.
7	Food packet, survival, ST.....	24 packets.....		.63		Edible without any preparation. Designed to maintain survival efficiency when eaten by 3 men in one day or one man in 3 days.
8	Food packet, survival, SA.....	24 packets.....		.63		Designed to feed one man for one day. Based on tentative specifications.
9	Sundries pack.....			.47	.40	Composed of essential toilet articles, tobacco, and confections necessary to the health and comfort of troops.
10	Spice pack, kitchen.....	Supplement 1,000 rations..	40.0	1.2		Provides spices and condiments for 1,000 field or operational Type B rations.

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	1	2	3	4	5	6	7
1	Type ration	Packaging information			Average weight per ration including packing (lb.)	Average weight per ration unpacked (food only) (lb.)	Remarks
		Number rations per package (case)	Weight per package (lb.) (case)	Volume per package (cu. ft.) (case)			
11	Special Items pack, hospital (hospital supplement ration).	25.....	50.0	1.4	2.0	.....	Composed of fruit juices, soups, milk, etc., required as special nourishment for hospital patients.
12	Special Items pack, first aid station (beverage pack, aid station).	.....	40.0	1.0	.....	.....	Composed of fruit juices and similar liquid diet items required for patients.
13	Grain.....	.....	.....	.....	.....	10	Average for horses and mules. Reduce by 50 percent on ship.
14	Hay.....	.....	.....	.....	.....	14	Average for horses and mules.
15	Salt.....	.....	.....	.....	.....	$\frac{1}{8}$	Average for horses and mules.
16	Dog.....	.....	.....	.....	.....	2	Average for 50-lb. Dogs.

83. Time Elements in Class I Supply

While the figures shown in this table are an approximate *average* for combat conditions, they should be used only as a guide when actual experience is lacking.

1	1	2	3
	Work	Daylight (min)	Dark (min)
2	Unload rations for one division at Class I distribution point and prepare for distribution to regiments or separate battalions.....	120	150
3	Distribution of Class I supplies to regiment by higher echelon at one distribution point.....	30	30
4	Distribution of Class I supplies to separate battalion by higher echelon or similar unit.....	15	15
5	Preparation of one day's Class I supplies for issue at regimental or battalion Class I distribution point.....	30	60
6	Physical distribution by regimental supply agencies of one field ration (transfer of loads) to kitchens.....	15	20
7	Kitchens to be taken off trucks, set up, and ready to begin cooking (or vice versa).....	20	20
8	Division of one ration into three meals at kitchens.....	15	20
9	Kitchens to cook and prepare for serving a hot meal, starting with a hot kitchen.....	120	150
10	Kitchens to prepare a cold noon meal. The issue of this meal to take place usually coincident with serving of breakfast. (Included in item next above).....	60	90
11	Serving a hot meal to troops from a kitchen truck when majority of men are served at the truck.....	45	60
12	Serving a hot meal to troops by means of carrying parties (assuming the kitchen truck not farther than 1,000 yards in rear of the company).....	90	120

Section III. CLASSES II AND IV SUPPLY—DIMENSIONS AND WEIGHTS

84. Items of Chemical Equipment

	1	1 2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	Truck.....	Trk, cml svc, M1.....	310	88	99	5.6	38.8
3	.....	Apparatus, decon, power-driven, truck-mounted, M3A2.....	254	87	96	5.6	29.2
4	Trailer.....	Trailer, cml svc, M1.....	242	88	99	2.7	28.2
5	.....	Trailer, cml handling, M2.....	210	89	32	2.5	8.6
6	Equipment.....	Set, equip, maint, and rep, M1.....	.....	.....	.....	3.5	9.0
7	.....	Repair set, Cml C equip, M9.....	.....	.....	.....	2.0	5.6
8	.....	Svc unit, flame thrower, combat veh, M4.....	.....	.....	.....	8.3	41.4
9	Laboratory.....	Lah, base, Cml C, M2.....	.....	.....	.....	9.0	33.9
10	.....	Lab, mobile, Cml C, M3.....	.....	.....	.....	1.2	3.4
11	.....	Impregnating, plant, clothing, M2.....	.....	.....	.....	35.9	178.8

¹ Items exceeding 1 short ton, uncrated.

² Weights of vehicles shown in column 6 are weights of vehicles not loaded.

85. Items of Engineering Equipment ^{1 2}

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	Equipment.....	Auger, earth, skid Mtd, gasoline engine driven.	228	96	108	2.5	-----
3	-----	Angledozer, Trac Mtd (35 hp).....	143	78	62	7.7	10.0
4	-----	Compressor, air, Trk Mtd, gasoline engine, 105 cfm.	254	90	93	7.1	35.5
5	-----	Compressor, air, Tlr Mtd, rubber tired, diesel engine driven, 315 cfm.	153	63	91	4.2	13.0
6	-----	Crane, Trk Mtd, ¾-cu yd.....	453	96	144	23.4	61.2
7	-----	Crane, Trk Mtd, ¾-cu yd.....	424	96	128	13.2	76.0
8	-----	Crane, revolving, crawler Mtd, ½ cu yd.	437	96	120	13.0	75.0
9	-----	Crane, Trac operated, nonrevolving 20-ton, 20-ft boom.	344	111	134	3.7	74.0
10	-----	Distributor, bituminous, Tlr Mtd, 1,250-gal.	194	92	102	5.3	26.3
11	-----	Ditching machine, ladder type, crawler Mtd, gasoline engine driven, 8-ft depth- 18- to 24-inch wide.	180	134	190	11.9	66.0
12	-----	Grader, road, Mtz, diesel engine driven, 12-ft moldboard.	360	103	91	4.3	38.6
13	-----	Grader, road towed type, leaning wheel, hand controlled, 10-ft moldboard.	332	118	96	6.4	64.0
14	-----	Grader, road towed type, leaning wheel, hand controlled, 6½-ft moldboard.	144	72	66	0.9	10.0
15	-----	Lubricator, Tlr Mtd.....	147	69	69	1.5	10.0
16	-----	Mixer, concrete, gasoline engine driven, 14-cu ft, Tlr Mtd.	120	108	120	3.6	23.0
17	-----	Power plant, SKW Tlr Mtd.....	144	72	72	1.5	11.0
18	-----	Roller, road, gasoline engine, 3-wheel, 10-ton.	207	76	120	10.0	27.0
19	-----	Roller, road, sheepsfoot w/removable feet.	128	56	59	1.5	5.2
20	-----	Rooter, road, cable operated, 5-tooth.....	204	100	67	3.7	24.0
21	-----	Scraper, road, towed, cable operated, 8-cu yd.	355	118	119	7.5	72.0
22	-----	Trac crawler type, diesel engine driven, 35 to 40 DBHP, standard with bulldozer tilting (D-4).	143	78	62	7.8	10.0
23	-----	Trac, diesel engine driven, 61 to 90 DBHP, standard with bulldozer tilting (D-7).	216	146	122	18.0	63.0
24	-----	Trac, wheeled, rubber tired, gasoline engine driven, 30 DBHP, standard.	108	66	75	3.0	8.0
25	-----	Trac, rubber tired, gasoline driven w/hydraulic Contl 23 DBHP.	123	58	58	1.7	6.0
26	-----	Trac, crawler type, gasoline driven, 20 DBHP, standard, complete, w/bydraulic Contl, bulldozer and winch.	147	83	72	2.2	13.0
27	-----	Trac, crawler type, Diesel engine driven 30-40 DBHP, rigid, w/loader bucket, cable operated, front Mtd, ¾ cu yd and bulldozer tilting.	176	80	124	8.1	25.0
28	-----	Welding Equip, set No. 1, electric arc, 300 amp, Tlr Mtd.	144	72	72	1.6	11.0
29	Boats.....	Boat, 25-ft power utility.....	314	104	48	-----	22.0

¹ Items exceeding 1 short ton, uncrated.² Weights of vehicles shown in column 6 are weights of vehicles *not* loaded.

1	1	2	3	4	5	6	7
	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
30		Boat, assault, M2, with paddles and canvas cover (6 per package).	160	64	25	2.0	3.7
31		Boat, storm	203	81	25	2.0	5.9
32	Bridges	Br, foot M-1038 (482-ft)				9.6	
33		Br, ponton, M4A2 (695-ft)				295.8	750.0
34		Br, floating, M4 (428-ft)				232.8	1638.0
35		Br, fixed, steel panel, Bailey-type, M2				55.0	140.0
36	Ferries	Raft set, No. 1, Inf. spt.				4.8	18.0
37	Electric light	Electric lighting Equip, set No. 3, 3KVA				1.0	
38		Electric lighting Equip, set No. 4, 5KW				1.5	
39	Trucks	Trk, cargo, treadway, 6-ton, 6 x 6, 4DT w/winch.	393	100	108	13.3	58.0
40	Plants	Crushing and screening plant, semi-trailer Mtd, 25-cu yd/hour.	390	96	126	19.7	68.4
41		Saw mill, 60-in, 1,200 FBM/hour 4 ft x 7 ft saw table.				19.0	40.0
42	Miscellaneous	Pioneer Equip, set No. 2				1.0	2.1
43		Pipe line Equip, set for 2½-ton truck				2.6	7.2
44		W Sup Equip, set No. 4				2.1	4.3
45	Trailer	Tlr, full bed, 8-ton	298	102	57	4.5	25.4
46		Shop Equip, Mtz, utility	264	96	120	8.3	44.0
47	Semitrailer	Low bed, front loading, 20-ton, w/o dolly	424	115	79	12.0	55.7

NOTE

See FM 5-35, Engineers' Reference and Logistical Data, for more complete information.

86. Major Medical Service Unit Assemblies

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Cons. Comb.	Item Nos.	Type unit assembly	TOE	Weight (lbs.)		Cube		No. packages		No. carloads		No. line items	
				Med. only	Comp. TOE	Med. only	Comp. TOE	Med. only	Comp. TOE	Med. only	Comp. TOE	Med. only	Comp. TOE
SAJ.....	9-314-850	Mobile Army Surgical Hosp., 60-bed.....	8-571A	50,080	88,276	3,305	5,249	448	793	2	3	1,314	1,487
SGN.....	9-195-800	Evacuation Hosp, Semi-Mob., 400-bed.....	8-581	83,655	228,007	5,189	13,410	1,045	2,097	2	5	3,065	3,314
SGM.....	9-196-450	Field Hospital, 400-bed.....	8-510	107,638	221,482	7,006	12,727	1,170	2,126	2½	6	4,048	4,597
SGY.....	9-195-830	Evacuation Hosp., 750-bed.....	8-580A	154,911	333,415	10,005	18,661	1,528	3,303	4	8	3,881	4,017
SGG.....	9-551-800	Station Hosp., CZ, 25-bed.....	8-561	18,600	38,200	1,100	2,010	90	200	LCL	1	1,022	1,200
SGF ¹	9-551-810	Station Hosp., CZ, 50-bed.....	8-562	28,905	62,500	1,967	4,039	289	566	1	2	1,463	1,778
SGE ²	9-551-830	Station Hosp., CZ, 100-bed.....	8-563	64,291	109,990	4,300	7,323	462	859	2	3	1,735	2,078
SG3/ ²	None	Station Hosp., CZ, 200-bed.....	8-564	77,752	120,000	5,225	7,500	790	1,600	2	3	1,950	2,185
SGD.....	9-551-850	Station Hosp., CZ, 250-bed.....	None	99,750	150,500	7,080	10,000	850	1,750	3	4	2,176	2,500
SG4/ ²	None	Station Hosp., CZ, 300-bed.....	8-565	120,000	160,500	8,500	14,000	925	1,790	3	4	2,746	3,032
SGC.....	9-551-880	Station Hosp., CZ, 500-bed.....	8-566	193,742	393,013	14,042	26,227	1,824	3,106	5½	10	2,563	3,046
SGE ²	9-551-910	Station Hosp., CZ, 750-bed.....	8-567	260,900	490,000	18,050	26,250	2,050	3,850	7	13	2,567	3,040
SGA ²	9-253-960	General Hosp., CZ, 1,000-bed.....	8-551	407,171	657,174	30,843	44,481	3,465	5,570	14	20	2,825	3,160
SGV ²	9-254-000	General Hosp., CZ, 1,500-bed.....	(8-552)	581,311	935,091	45,388	64,277	4,888	8,031	20	26	3,070	3,419
SGW.....	9-254-050	General Hosp., CZ, 3,000-bed ¹	(8-553)	690,000	1,255,050	60,000	84,010	6,100	12,100	18	32	4,000	4,300
SHB ²	9-144-295	Convalescent Center Army 1,500 Patient.....	8-590	80,000	380,000	5,150	21,000	750	3,100	2	10	977	1,219
SGQ ²	9-144-295	Convalescent Center Army 1,500 Patients, Army....	8-590	120,000	640,000	8,700	40,100	1,100	5,500	3	16	1,405	1,900
SGT.....	9-252-700	General Dispensary, Type 1.....	8-500	8,942	13,004	447	665	101	152	LCL	LCL	552	633
SGT ²	9-252-800	General Dispensary, Type 2.....	8-500	6,450	10,500	350	440	85	130	LCL	LCL	551	635
SAB ²	9-014-600	Air Group Dispensary, 36-bed.....	1-9022T 1-9012	12,944	20,516	804	1,237	147	220	LCL	LCL	398	493
SGR ²	9-259-740	Medical General Laboratory, CZ.....	8-650	37,500	50,500	4,100	5,000	200	285	1	2	1,405	1,531
SGS.....	9-259-760	Medical Laboratory, Army.....	8-640	64,369	95,000	6,800	8,050	200	285	2	3	1,422	1,548

¹ Proposed.² Estimate.

87. Items of Ordnance Equipment^{1 2}

a. Amphibious Vehicles.

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	Truck.....	2½-ton, 6 x 6 Amph DUKW.....	372	99	*101	7.4	55.9
3	Landing vehicle tracked.	MK 4, LVT (4), unarmored.....	314	128	99	13.7	71.5
4	Landing vehicle tracked.	MK 4, LVT(A) (4), armored.....	313	128	125	20.0	72.5
5	Landing vehicle..	MK 5, LVT (1) (5), armored.....	313	128	123	19.9	75.4
6	Carrier.....	Cargo M29C, amphiblan.....	192	67	71	3.0	13.2

*Reducible to 90 inches.

b. Ground Combat Vehicles.

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	Car.....	Armored, light, 6 x 6, M8*.....	197	100	88	8.6	25.2
3	Car.....	Armored, utility, M20, 6 x 6.....	197	100	91	7.8	25.9
4	Carrier.....	Cargo, M29.....	126	66	71	2.3	8.5
5	Carrier.....	Vehicle, armored, utility, M39.....	214	113	80	16.8	28.2
6	Carrier.....	Infantry vehicle, armored, tracked, M75.	209	108	95	14.3	30.6
7	Carrier.....	Infantry vehicle, armored, tracked, T59.	221	129	88	19.4	36.3
8	Carrier.....	Cargo, amphibious, M76 (T46E1).....	193	98	103	4.4	28.4
9	Half track.....	Carriage, motor, multiple, gun (50 cal AAA) M16A1.	257	85	103	9.3	32.0
10	Half track.....	Carrier, 81-mm mortar, half track, M21.	249	88	87	7.8	27.4
11	Half track.....	Carrier, personnel, half track, M3*.....	249	88	89	7.8	28.1
12	Half track.....	Carrier, personnel, half track, M3A1*.....	250	88	106	7.7	33.5
13	Carriage motor...	Twin, 40-mm gun, M19A1 (Gun M2 on twin mount, M4).	218	112	119	18.5	39.5
14	Carriage motor...	Gun, twin, SP, T141.....	244	129	111	2.15	47.5
15	Carriage motor...	76-mm gun, M18 M1A2 Gun.....	262	113	101	19.5	34.0
16	Carriage motor...	90-mm gun, M36 M3 Gun.....	235	120	126	30.5	35.6
17	Carriage motor...	105-mm howitzer, M37 M4 Howitzer.....	216	118	112	23.0	39.0
18	Carriage motor...	105-mm howitzer, SP T98E1 T96E1 Howitzer.	215	128	134	25.0	53.6
19	Carriage motor...	8-inch howitzer, M43 M1 Howitzer.....	289	124	130	40.0	67.2
20	Carriage motor...	8-inch howitzer, SP T108 T89 Howitzer.	325	140	140	45.0	92.7
21	Carriage motor...	155-mm gun, M40 M2 Gun.....	357	124	130	40.5	67.2
22	Carriage motor...	155-mm gun. T97 T80 Gun.....	402	140	140	46.0	114.6
23	Carriage motor...	155-mm howitzer, SP, T194, T186E1 howitzer.	240	128	122	31.0	54.6

*Limited standard.

¹ Items exceeding 1 short ton, uncrated.

² Weights shown in column 6 for combat vehicles, except half tracks, are fighting (loaded) weights. Those for half tracks and noncombat vehicles are weights of vehicles not loaded.

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	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
24	Carriage motor...	155-mm howitzer, M41 M1 Howitzer...	230	112	96	21.5	38.2
25	Tractor.....	Truck, Gun lifting, heavy, 4 x 4 Front M249 (Transports 280-mm gun).	368	124	120	15.0	79.1
26	Tractor.....	Truck, Gun lifting, Heavy 4 x 4; Rear M250 (Transports 280-mm Gun).	369	124	120	14.5	79.3
27	Tank.....	Light M24 (T24) (75-mm gun M6).....	198	116	109	20.3	36.1
28	Tank.....	Medium (heavy) M46, (90-mm gun M3A1).	276	138	125	46.0	69.0
29	Tank.....	Medium (heavy) M47, (90-mm gun M36).	276	138	117	46.5	69.0
30	Tank.....	Medium (heavy) T48 (90-mm gun M41).	289	146	115	41.7	68.4
31	Tank.....	Heavy, T43 (120-mm gun T123).....	397.5	146	127	55.8	104.0
32	Tank.....	Medium, M4A3 (76-mm gun M1A2)...	296	105	135	35.6	60.4
33	Tank.....	Medium (heavy) M26 (90-mm gun M3).	268	137	109	43.3	57.9
34	Tank.....	Medium, M45 (105-mm howitzer).....	252	139	110	46.2	55.6
35	Tank.....	Light, M41 (76-mm gun M32).....	264	130	111	25.5	56.9
36	Recovery and evacuation.	Truck, 12-ton, 6 x 4, Prime Mover, M20 (Tows Trailer M9).	280	100	101	13.5	35.8
37	Recovery and evacuation.	Trailer, 45-ton, 12 wheel M9 Transporter.	360	114	62	10.1	36.3
38	Recovery and evacuation.	Semitrailer, 45-ton 8 wheel transporter, M15 and M15A1.	462	150	105	18.1	86.9
39	Recovery and evacuation.	Truck, tractor, 12-ton, 6 x 6, M26, M26A1 (tows semitrailer M15).	307	131	118	24.4	73.9
40	Recovery and evacuation.	Vehicle, tank recovery, M32, M32A1...	278	110	116	33.6	51.4

c. Tractors (less those peculiar to other technical services).

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	High speed.....	13-ton M5.....	191	100	104	14.3	28.8
		13-ton M5A1.....	197	100	123	15.2	28.8
		13-ton M5A2.....	191	115	104	13.1	28.8
		13-ton M5A3.....	107	115	105	15.2	28.8
3	High speed.....	18-ton M4, M4C, M4A1, M4A1C.....	203	97	99	15.7	28.2
4	High speed.....	38-ton, M6 (Hv).....	258	121	104	38.0	45.5
5	High speed.....	Cargo, M8E2 w/T8E4 Bulldozer.....	301	131	120	30.8	68.4
6	High speed.....	Cargo, M8E2.....	265	131	120	27.5	60.3

d. Truck Tractors.

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	1½-ton	Truck, 4 x 2	202	86	84	2.9	21.2
3	2½-ton	Truck, 6 x 6 M48	240	93	82	5.7	28.0
4	5-ton	Truck, 6 x 6 M52	257	97	102	9.2	36.8
5	10-ton	Truck Tractor, 6 x 4	257	96	100	7.6	

e. Trucks.

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	¼-ton.....	4 x 4, Utility M38A1.....	139	62	55	1.3	6.6
3	¾-ton.....	4 x 4, Ambulance M43.....	198	74	92	3.6	19.7
4	¾-ton.....	4 x 4, Command M42.....	185	74	90	3.0	17.9
5	¾-ton.....	4 x 4, Cargo M37.....	189	74	90	3.0	18.4
6	2½-ton.....	6 x 6, Cargo LWB M35.....	261	96	111	6.3	45.3
7	2½-ton.....	6 x 6, Cargo XLWB M36.....	323	96	125	6.8	56.0
8	2½-ton.....	Watertank, 1,000 Gal.....	262	95	92	6.6	33.2
9	2½-ton.....	Gasoline Tank, 1,200 Gal.....	262	95	92	6.9	33.2
10	2½-ton.....	6 x 6, Dump M47.....	236	96	108	7.3	35.5
11	5-ton.....	6 x 6, Cargo M41.....	294	97	111	9.9	46.1
12	5-ton.....	6 x 6, Wrecker.....	348	97	106	16.8	51.7
13	7½-ton.....	6 x 6, Prime Mover.....	297	103	125	14.6	55.5

f. Miscellaneous Motor Vehicles.

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	-----	Motorcycle, solo, chain-driver.....	88	37	59	0.3	1.9
3	-----	Automobile, Sedan, light, 5 passenger.....	197	74	66	1.7	14.0
4	-----	Automobile, Sedan, Medium, 5 passenger.	207	76	63	1.8	14.4
5	2½-ton.....	Truck, Crane, 6 x 6.....	301	96	99	9.9	41.7
6	2½-ton.....	Truck, Shop Van, 6 x 6.....	150	96	129	7.5	27.0
7	2½-ton.....	Truck, Medical Van, 6 x 6.....	150	96	129	7.5	27.0

g. Trailers (less those peculiar to other technical services).

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	¼-ton.....	Cargo, 2-wheel M100.....	109	56	42	0.3	3.7
3	¾-ton.....	Cargo, 2-wheel M101.....	147	74	83	.7	13.2
4	1½-ton.....	Cargo, 2-wheel M104.....	166	83	97	1.2	19.3
5	1½-ton.....	Water tank, 2-wheel, 400 gallon M106..	166	93	78	1.2	17.5
6	.....	Ammunition, M10.....	140	86	58	1.0	10.1
7	.....	Director, M22 (AA).....	189	96	100	4.5	26.1
8	.....	Generators, M7 (AA).....	189	96	44	2.1	11.5

h. Semitrailers (less those peculiar to other technical services).

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	6-ton.....	Cargo, 2-wheel.....	274	93	96	3.6	35.6
3	6-ton.....	Van type, 2-wheel.....	276	96	134	3.7	51.5
4	12-ton.....	Cargo, 4-wheel.....	344	97	109	6.9	52.9
5	.....	Gasoline, Tank, 4-wheel, 5,000 gallon..	353	97	109	7.4	54.2
6	12½-ton.....	Semitrailer 4W.....	600	97	93	6.5	-----
7	25-ton.....	Semitrailer lowbed 8W.....	403½	115½	63½	6.5	-----
8	60-ton.....	Model ME-1 Semitrailer 8W.....	442	144	81	6.0	-----
9	20-ton.....	Semitrailer S&P 4W, 34 ft.....	413½	96½	122¾	6.3	-----
10	20-ton.....	Semitrailer Van 4W, 34 ft.....	413	96½	137½	6.3	-----

i. Towed Weapons.

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	Antiaircraft M.G.	Multiple mount, Tlr, M55 (cal. 50)....	112	68	60	1.8	-----
3	Antiaircraft Gun.	Gun, 40-mm, M1 (carrier M2A1, AA)....	226	72	80	2.9	18.8
4	.....	Gun, 75-mm, T83E7 (Mount T69).....	305	102	85	9.6	38.3
5	.....	Gun, 90 mm, AA, M2 (mount M2, AA).	355	103	121	16.1	64.0
6	.....	Gun, 120-mm, AA, M1A3 (mount M1A1, AA).	369	124	124	30.7	81.6
7	FA Howitzer.....	75-mm, pack, M1A1 (carriage M8).....	144	47	34	0.6	3.9
8	.....	105-mm, M2A1 (carriage M2A2).....	236	82	66	2.5	18.5
9	.....	155-mm, M1 (carriage M1A2).....	288	96	81	6.0	32.4
10	.....	8-in. M2 (carriage M1)*.....	480	99	103	15.8	70.8

*With limber.

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
11		240-mm, M1 (carriage M1)					
12		Wagon, cannon Trans, M2A1.....	398	108	84	19.8	52.0
13		Wagon, carriage Trans, M3A1.....	370	114	120	21.1	69.5
14		Crane, truck mounted M2.....	403	109	140	27.0	93.0
15		Tlr, clam shell, M16.....	171	108	124	4.1	42.8
16	FA Gun.....	155-mm, M2 (carriage M1)*.....	412	99	109	15.3	63.7
17		8-in. M1 (carriage M2)					
18		Wagon, cannon Trans. M1A1.....	497	116	84	25.5	70.3
19		Wagon, carriage Trans, M3A1.....	433	119	129	26.3	95.8
20		Crane, Trk Mtd, M2.....	403	109	140	57.3	93.0
21		Tlr, clam shell, M16.....	171	108	124	4.1	42.8
22		280-mm, T131 (carriage T72) (with gun lifting trucks M249 and M250).	1010	124	146	76.0	264.5
23	Launcher	Rocket, multiple 4.5 inch, M21.....	179	80	58		

*With limber.

88. Items of Quartermaster Equipment^{1 2}

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	Trailers.....	Bath Unit, Field, Mobile.....	151	72	68	2.1	10.6
3		Laundry, Mobile, Two-Trailer Type:					
4		Washer Trailer.....	168	78	84	2.5	15.9
5		Tumbler Trailer.....	168	78	84	2.5	15.9
6		Bakery Unit, Mobile, M-1945:					
7		Mixing and Make-up Machinery Trailer.	197	88	111	5.5	18.7
8		Oven Trailer.....	200	88	83	3.3	20.8
9		Proofing and Water Trailer.....	207	90	100	3.3	27.0
10		Engine Generator Trailer (25 KW, 1-ton, mounted).	244	70	76	1.8	18.8
11		Reclamation and Maintenance, 2-ton:					
12		Clothing Repair Trailer.....	108	67	66	0.9	6.9
13		Textile Repair Trailer.....	108	67	66	0.9	6.9
14		Shoe Repair Trailer.....	108	67	66	0.9	6.9
15	Semitrallers.....	6-ton Clothing Repair.....	269	94	132	10	48.3
16		6-ton Laundry.....	269	96	132	10	49.4
17		5-ton Refrigerator.....	242	96	129	11	44.2
18		10-ton Refrigerator.....	257	94	129	13.7	45.1
19		6-ton Shoe Repair.....	270	96	131	10	48.7
20		6-ton Textile Repair.....	270	96	132	10	49.5
21		Petroleum Lahoratory, Mobile.....	300	96	118	9.5	49.2

¹ Items exceeding 1 short ton, uncrated.² Weights of vehicles shown in column 6 are weights of vehicles *not* loaded.

89. Items of Signal Equipment

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
2	Radios.....	SCR—399 Including Tlr.....				3.3	30.0
3		SCR—499.....				1.5	5.0
4		AN/GRC-26 Including Tlr.....				3.5	30.0
5	Truck.....	Sig Corps Rep M 30, 2½-ton 6x6.....	256	92	118	8	40.1
6		TP Const & Main V-17/MTQ, 2½-ton 6 x 6.....	265	88	108	5.5	32.0
7		Earth Auger V-18/MTQ, 2½-ton 6 x 6.....	265	88	108	5.5	32.0
8		TP Inst & Rep V-41, ¾ ton 4 x 4.....	196	72	75	2.1	15.3
9	Trailer.....	Cable Hauler, K-37, 2W.....	149	84	69	1.5	9.0
10		Cable Splicer, K-38, 2W.....	77	39	42	.2	1.8
11		Pole Hauling, V-13/GT 2W.....	185	88	60	1.2	6.2
12		1 Ton, Cargo, K-52.....	145	72	73	1.5	11.0
13		Central office set magneto and common battery type corps Equip.....				1.8	3.6
14		Central office set, common battery type Army Equip.....				5.3	13.6
15		Rad relay Equip, FM, about 50 watts, 25-mi. range.....				2.2	4.7
16		Ground, Trans Rad Equip AM, about 50-watts range, 100-mi. (CW).....				1.0	2.5
17		Ground, Mbl Rad Equip, AM, about 400-watts. Range 100-300-mi. (CW).....				5.0	22.4

90. Items of Transportation Equipment ^{1 2}

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas tons
			(Dimensions—in.)				
2	Barge, nonpropelled.	Deck or liquid cargo, 580-tons or barrels, 120-foot, design 213-B.	1,440	396	120	185	990
3	Barge, self-propelled.	Cargo, steel, 125-foot, design 219-A.	1,500	385	162	338.6	1,350
4	Tug	Harbor, diesel, 200-hp, steel, 45-foot, design 320.	540	150	96	32	112.5
5	Utility boat	Passenger and cargo, 75-hp, wood, 40-foot, design 186.	400	128	84	8.4	74.6
6	Patrol boat	Gasoline, 630-hp, wood, 63-foot, design 416.	756	180	105	19.5	206.7
7	Floating crane	Revolving, diesel-electric, 30-ton, steel, design 317-A.	1,344	624	114	685.4	1,383
8	Repair shop	Floating, nonpropelled, 112-foot, design 440.	1,344	360	96	242	672
9	Propulsion unit	Marine, outboard, diesel, 300-hp, design 0-7.	170	69	85	10	13.2
10	Locomotive, steam. (36-39 3/4-42-in.).	60-ton, 2-8-2 road tender	428 1/2	102 3/4	136	52	89.3
			285	102 3/8	136	20.8	57.5

¹ Items exceeding 1 short ton, uncrated.² Weights of vehicles shown in column 6 are weights of vehicles *not* loaded.

	1	2	3	4	5	6	7
1	Class	Type or model	Length	Width	Height	Short tons	Meas. tons
			(Dimensions—in.)				
11	Locomotive, steam. (56½-60-63-66-in.).	82-ton, 2-8-0 road tender.....	393½ 286	116 116	163 163	74 23.2	107 77.8
12	Locomotive, DE. (36-39 ¾-42-in.).	48-ton, 0-4-4-0 road switcher.....	420	102	136	58	84.3
13	Locomotive, DE. (56½-60-63-66-in.).	48-ton, 0-4-4-0 road switcher.....	420	102	136	58	84.3
14	Locomotive, DE. (56½-60-63-66-in.).	120-ton 0-6-6-0 road switcher.....	642	116	163	116.2	175.6
15	Railway cars..... (36-39 ¾-42-in.).	Box, 30-ton.....	458½	95½	128¾	13.6	*50.6
		Gondola, low side, 30-ton.....	458½	95½	62	12.1	*24.0
		Gondola, high side, 30-ton.....	458½	95½	92	13.3	*27.5
		Flat, 30-ton.....	458½	95½	44	11.0	*20.6
		Tank, 5,000-gal.....	419¾	95½	145	17.6	84.0
		Refrigerator, 30-ton.....	458½	95½	128¾	16.5	*50.6
		Ambulance, ward.....	734½	100	133¾	46	140.4
		Ambulance, kitchen-diner-storage.....	734½	100	133¾	45.5	140.4
16	Railway cars..... (56½-60-63-66-in.).	Ambulance, personnel.....	734½	100	133¾	45	140.4
		Box, 40-ton.....	530¾	114	139½	18	*59.0
		Gondola, low side, 40-ton.....	530¾	114	74½	15.2	*28.0
		Gondola, high side, 40-ton.....	530¾	114	104½	17.7	*32.1
		Flat, 40-ton.....	530¾	114	56½	14.4	*24.0
		Flat, 80-ton.....	603½	116	52½	35.5	*27.6
		Tank, 10,000-gal.....	505½	114	157½	20	140.5
		Refrigerator, 40-ton.....	530¾	114	139½	19	*59.0
		Ambulance, ward.....	794	114	157	55.2	179.3
		Ambulance, kitchen-diner-storage.....	794	114	157	54.7	179.3
17	Sled.....	Ambulance, personnel.....	794	114	157	54.2	179.3
		Micheler, 10-ton.....	288	96	36	5	14.4
		Snowmobile.....	L'auto Neige Bombardier.....	206	76	76	1.6	17
18	Truck.....	Amphibian, 2½-ton, 6x6, DUKW.....	372	98	106	7.4	55.9
		Gasoline tank, 2½-ton, 6x6, 750-gal, LWB.	254	91	88	7.7	29.4
19	Semitrailers.....	10-ton, cargo.....	363	96	134	6.6	68.5
		Gasoline tank, 2,000-gal.....	306	93	96	4.3	39.5
		5-ton refrigerator.....	242	96	129	7.5	44.2

*Knocked down.

91. Items of Construction and Fortification Materials*

a. Engineer.

1	Type or model	2	3
		Short tons	Meas. tons
2	Asphalt/mile.....	65.0	54.0
3	Cement.....	1.0	.53
4	Explosive (60% dynamite).....	1.0	1.0
5	Track, 75 lb/yard, rail/mile of track.....	132.0	40.0
6	Track, rail turnout, complete, 75 lb/yard, each.....	9.0	6.3
7	Sand bags, per 100,000.....	16.5	100.0
8	Loose, pit run gravel.....	1.4	1.0
9	Crushed rock, loose.....	1.34	1.0
10	Pipe, 4-in, with fittings (1-mi).....	24.2	-----
11	Pipe, 6-in, L, with fittings and pump (1-mi).....	33.0	-----
12	Pipe, 6-in, Hv, with fittings and pump (1-mi).....	49.5	-----
13	Tank, 10,000-barrel, steel.....	46.0	-----

b. Signal.

14	Wire, WD-1()/TT on spool DR-8().....1,320 ft., 13 lbs.		
15	Wire, WD-1()/TT on wire reel RL-159()/U.....5,280 ft., 66 lbs.		
16	Wire, WD-1()/TT on reel DR-5.....2½ mi., 145 lbs.		
17	Wire, WD-1()/TT on wire dispenser MX-306()/G (wire, WD-1)/(TT alone weighs 46 lb per mile).....2,640 ft., 26 lbs.		
18	100-mi requirements (spiral four cable) without poles.....	50	74
19	Same with poles.....	211	318
20	300 miles, open wire, crossarms, hardware, etc., without poles.....	527	502
21	Same with poles.....	3,067	3,842
22	100-mi tactical radio (radio relay with carrier Equip).....	42	104

*Items exceeding 1 short ton, uncrated.

Section IV. CLASS III SUPPLY

92. Liquid Fuel and Lubricant Data

a. Vehicles.

1	Vehicle	2	3 ¹	4 ¹	5	6
		Vehicle fuel tank capacity (gal)	Fuel per 100 miles (gal)	Oil per 100 miles (gal)	Gear lubricant per 100 miles (lb)	Miscellaneous greases per 100 miles (lb)
2	Car, armored, light, M8.....	56	19	1.5	.5	1
3	Car, armored, utility, M20.....	54	19	1.5	.5	1
4	Car, half-track, M2.....	60	30	1.9	.5	1
5	Car, half-track, M2A1.....	60	34	1.7	.5	1
6	Car, 5 passenger, light sedan.....	16	5.8	.2	.1	.1
7	Car, 5 passenger, medium sedan.....	17	6	.2	.1	.1
8	Car, 7 passenger, heavy sedan.....	20	7	.2	.1	.1
9	Carriage, motor, multiple gun, M16A1.....	60	34	1.8	1.0	2.4

See footnotes at end of table.

1	2	3	4	5	6
Vehicle	Vehicle fuel tank capacity (gal)	Fuel per 100 miles (gal)	Oil per 100 miles (gal)	Gear lubricant per 100 miles (lb)	Miscellaneous greases per 100 miles (lb)
10 Carriage, motor, twin 40-mm gun, M19A1.....	110	135	2.2	1.0	2.5
11 Carriage, motor, 75-mm gun, M18.....	155	110	3.3	2.1	1.5
12 Carriage, motor, 105-mm how, M37.....	110	110	2.7	1.5	2.5
13 Carriage, motor, 155-mm gun, M40.....	195	195	3.7	1.5	1.5
14 Carriage, motor, 155-mm how, M41.....	110	111	4.0	1.5	2.4
15 Carriage, motor, 8-inch how, M43.....	195	195	5.0	1.5	3.0
16 Carrier, cargo, M29.....	35	20	1.5	.8	.5
17 Carrier, cargo, amphibian, M29C ¹	35	23	1.5	1.0	.5
18 Carrier, cargo, amphibian, M76 (T46E1).....	60	30	2.2	.8	1.5
19 Carrier, half-track, M9A1.....	60	34	1.5	.5	1
20 Carrier, half-track, mortar, 81-mm, M21.....	60	34	1.4	.5	1
21 Carrier, 4.2-inch mortar, Tr., T84.....	130	130	2.0	-----	2.0
22 Compressor, air, trk-mtd.....	40	13.3	.3	.5	.3
23 Crane, truck mounted, ¾ yd capacity.....	50	40	.4	.8	.4
24 Grader, Road, Mtd, diesel.....	27	72	.8	12.5	2.0
25 Gun, twin 40-mm, SP, M42 (T141).....	140	140	4.0	1.5	2.0
26 Gun, 155-mm, SP, T97.....	350	234	4.0	1.7	2.8
27 Howitzer, 105-mm, SP, T98E1.....	174	200	4.1	1.5	2.5
28 Howitzer, 155-mm, SP, M44 (T99E1).....	150	200	3.9	1.5	2.5
29 Howitzer 8-inch, SP, T108.....	350	234	4.0	1.7	2.8
30 Landing Vehicle, tracked, MK4 ²	140	L71	3.6	1.5	3.0
31 Landing Vehicle, tracked, armored, MK4 ³	106	W140 L70	2.7	1.5	3.0
32 Landing Vehicle, tracked, armored, MK5 ³	105	W140 L71	3.0	1.5	3.0
33 Motorcycle, solo.....	3.5	W140 2.4	.2	.1	.1
34 Motor, scooter.....	2.0	2.0	.2	.1	.1
35 Shop Equipment, Mtd, GP.....	45	20	.4	.8	.4
36 Tank, light, M24.....	110	110	2.6	1.5	2.5
37 Tank, 75-mm gun, M4A1.....	172	172	3.7	1.5	2.5
38 Tank, 75-mm gun, M4A3.....	175	207	2.9	1.5	3.0
39 Tank, 75-mm gun, T41E1 (M41).....	140	140	3.7	1.5	2.5
40 Tank, 90-mm gun, M26 & M26A1.....	186	248	2.9	1.5	2.7
41 Tank, 90-mm gun, M46 & M45A1.....	232	290	5.2	1.5	2.8
42 Tank, 90-mm gun, M47.....	232	290	5.5	1.5	2.5
43 Tank, 90-mm gun, M48.....	215	295	5.1	2	1
44 Tank, 105-mm how, M4A3.....	175	207	2.9	1.5	3.0
45 Tank, 105-mm how, M45.....	190	241	3.7	1.5	2.5
46 Tank, 120-mm gun, T43E1.....	280	350	5.2	1.5	2.5
47 Tank, flame thrower, T67.....	215	295	5.1	2.0	1.0
48 Tractor, cargo, M8E1 & M8E2.....	225	125	3.8	1.5	3.0
49 Tractor, high-speed, 13-ton, M5.....	80	53	2.0	1.5	2.0
50 Tractor, high-speed, 18-ton, M4.....	125	125	2.1	1.5	2.0
51 Tractor, high-speed, 38-ton, M6.....	300	330	2.8	1.5	2.0
52 Truck, utility, ¼-ton, 4 x 4.....	17	6	.2	.2	.2
53 Truck, ¾-ton, 4 x 4.....	24	12	.2	.3	.3
54 Truck, 1½-ton, 4 x 4.....	30	13.3	.3	.5	.3
55 Truck, 1½-ton, 5 x 6.....	30	12.5	.3	.5	.3
56 Truck, amphibian, 2½-ton, 5 x 5 (DUKW) ⁴	40	15.7	.6	.9	.3
57 Truck, 2½-ton, 5 x 6, M35.....	50	18	.4	.8	.4
58 Truck, 2½-ton, 5 x 6, M135.....	56	22.2	-----	-----	-----
59 Truck, 2½-ton, 5 x 5, M211.....	56	17.2	-----	-----	-----
60 Truck, 4-ton, 5 x 5.....	60	34	.5	1.2	.8
61 Truck, wrecker, 4-ton, 5 x 5.....	60	34	.6	1.2	.8

See footnotes at end of table.

	1	2	3 ¹	4 ¹	5	6
	Vehicle	Vehicle fuel tank capacity (gal)	Fuel per 100 miles (gal)	Oil per 100 miles (gal)	Gear lubricant per 100 miles (lb)	Miscellaneous greases per 100 miles (lb)
62	Truck, 5-ton, 6 x 6, M41.....	70	25	.6	.9	.8
63	Truck, 5-ton, 6 x 6, M54.....	78	32.3	.8	.4	.5
64	Truck, medium wrecker, 5-ton, 6 x 6, M62.....	78	37	.8	.4	.5
65	Truck, prime mover, 6-ton, 6 x 6.....	75	50	.9	.7	1.0
66	Truck, heavy wrecker, 6-ton, 6 x 6, M1A1.....	100	40	.9	.8	1.0
67	Truck, prime mover, 7½-ton, 6 x 6.....	160	40	.8	.8	1.0
68	Truck, crane, M2.....	100	66.7	.7	.7	.5
69	Truck, gun, lifting, heavy, 4 x 4, front, M249.....	140	100	-----	-----	-----
70	Truck, gun, lifting, heavy, 4 x 4, rear, M250.....	140	100	-----	-----	-----
71	Truck-tractor, 4-5 ton (7-ton semi-trailer).....	60	22	.6	1.2	.8
72	Truck-tractor, 5-ton, 6 x 6, M52.....	110	34	.6	.9	.8
73	Truck-tractor, 5-6 ton (10-ton semi-trailer).....	110	34	.8	1.0	.9
74	Truck-tractor, 12-ton, 6 x 6, M26 & M26A1 (tk transporter).....	120	100	1.5	.9	1.1
75	Vehicle, Armored Infantry, tracked, M59.....	130	130	2	-----	2
76	Vehicle, Armored Infantry, tracked, M75 (T18E1).....	150	130	3.2	-----	2.5
77	Vehicle, Armored, Utility, M39.....	165	110	2.0	1.5	2.5
78	Vehicle, tank recovery, M32 series.....	175	155	4.0	1.5	2.5
79	Vehicle, recovery, heavy, M51.....	385	296	4.1	2.0	2.5

¹ For arctic winter operations, increase amounts by 25 percent.

² In water, the weasel, M29C, uses 2¼ gallons of fuel per hour.

³ In water, use 0.6 mile per gallon.

⁴ In water, use 1.3 miles per gallon.

b. Locomotives.

(1) *Fuel oil* (oil burning steam locomotives).

	1	2	3	4
	Type of locomotive	Type of operation	Estimated average rate of fuel oil consumption	
			Pounds/ train mile	Pounds/ hour
2	2-8-2 standard gage.....	Road.....	60	500
3	2-8-0 standard gage.....	Road.....	55	450
4	2-8-2 narrow gage.....	Road.....	60	500
5	0-6-0 standard gage.....	Switch.....	-----	400
6	0-6-0 narrow gage.....	Switch.....	-----	400

(2) *Diesel oil* (diesel-electric locomotives).

	1	2	3	4
1	Type of locomotive	Type of operation	Estimated average rate of diesel oil consumption	
			Gallons/ train mile	Gallons/ hour
2	Standard gage:			
	0-6-6-0 DE 120 T.....	Roadswitcher.....	2.5	7.5
	0-4-4-0 DE 80T.....	Roadswitcher.....	1.5	6.0
	0-4-4-0 DE 48T.....	Roadswitcher.....	.9	4.0
3	Narrow gage:			
	0-6-6-0 DE 80T.....	Roadswitcher.....	1.5	6.0
	0-4-4-0 DE 48T.....	Roadswitcher.....	.9	4.0

In estimating fuel requirements, it is recommended 5 percent be added to computed rate of consumption to allow for contingencies.

(3) *Lubricants*. Estimated lubricating oil and grease requirements for motive power and rolling stock: 1,000 pounds per month for each train per day (moving in either direction) over each division.

c. *Marine*.

	2	3	4
1	Type	Type or fuel	Estimated average rate of consumption in gallons per hour
	Barge, self-propelled, 125-foot, design 219-A.....	Diesel.....	45.2
	Tug, harbor, 200-hp, steel, 45-foot, design 320.....	Diesel.....	14
	Utility boat, 530-hp, wood, 26-foot, design 207A.....	Diesel.....	4
	Patrol boat, 630-hp, wood, 63-foot, design 416.....	Gasoline.....	72
	Propulsion unit, outboard, 300-hp, design 0-7.....	Diesel.....	35

93. Bulk Petroleum Distribution

	1	2
1	Type carrier	Amount carried
2	Ships (large tankers).....	2.5 to 11 million gallons. ¹
3	Ships (small tankers).....	600,000 to 2,000,000 gallons. ²
4	Barges, harbor and canal types.....	15,000 to 30,000 gallons. ³
5	Barges, coastwise types.....	200,000 to 400,000 gallons. ⁴
6	Barge, Navy pontoon type.....	84,000 gallons. ⁵
7	Railroad tank cars.....	8,000, 10,000, 12,000 gallons.
8	Truck-tractor and trailer F-1.....	4,000 gallons.
9	Truck-tractor and 2 trailers F-1A.....	8,000 gallons.
10	Truck-tractor and trailer F-2.....	2,000 gallons.
11	Truck-tractor and 2 trailers F-2A.....	4,000 gallons.
12	Tank-truck, F-3, fuel or oil.....	750 gallons.
13	Tank-truck L-2, oil service.....	660 gallons.
14	Trailer, fuel servicing.....	600 gallons.
15	Pipelines	
	4".....	288,000 gallons per day.
	6".....	600,000 gallons per day. ⁶
	8".....	1,670,000 gallons per day.
16	Tanks, bolted steel.....	10,500, 42,000, 420,000 gallons.
17	Tank, portable fabric.....	10,000 gallons. ⁷

¹ The ship tanker most commonly used is the T2-SE-A1, a 5,922,000 gallon tanker. It is 425 feet long and draws 31 feet. It has three 8-inch flanged discharge outlets and four discharge pumps rated 1,000 gpm at 100 psi.

² Draft loaded, 12 to 20 feet.

³ Rectangular hulls.

⁴ Molded hulls.

⁵ 6 x 18 pontoon barge carrying three 42,000-gallon tanks loaded to two-thirds capacity.

⁶ Based on 30,000 gal/hr for 20 hours of operation.

⁷ 40 ft. long, 12 ft. wide, 3 ft. high when filled. Empty, it is rolled to 20 in. diam. by 12 ft. long. Ten can be carried in a 6 x 6 truck.

94. Weights, Volumes, and Conversion Factors for Petroleum Products

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Product	Packaging	Weight (pounds)	Cubic feet		Conversion factors		Gallons per short ton	Gallons per long ton	Gallons ¹ per measurement ton	Barrels ¹ per long ton	Pack-ages per short ton	Pack-ages per long ton	Pack-ages per measurement ton	Capacity of vehicles for carrying container ²		
			Actual	Planning factor	Gallons to pounds	Pounds to gallons								1-ton tlr	2½-ton trk	5-ton trk
2 Aviation gasoline...	Bulk.....				5.94	0.168	338	376		8.93						
	55-gal drums ³	359	11.2	12	7.14	.145	290		177		5.57	6.24	3.33	6	14	23
	5-gal drums.....	41.1	.95	1	8.06	.124	248		200		48.7	54.5	40.0	50	120	240
3 80-octane gasoline...	Bulk.....				6.14	.163	320	365		8.69						
	55-gal drums ³	378	11.2	12	7.33	.136	273		177		5.29	5.93	3.33	6	14	23
	5-gal drums ⁴	41.9	.95	1	8.30	.121	241		200		47.7	53.5	40.0	50	120	240
4 Kerosene.....	Bulk.....				6.80	.147	294	330		7.86						
	55-gal drums ³	407	11.2	12	7.94	.126	252		177		4.91	5.50	3.33	5	12	25
	5-gal drums.....	45.2	.95	1	8.85	.113	226		200		44.2	49.6	40.0	45	110	220
5 Diesel fuel.....	Bulk.....				6.99	.143	286	320		7.62						
	55-gal drums ³	423	11.2	12	8.23	.122	243		177		4.73	5.30	3.33			
	5-gal drums.....	46.2	.95	1	9.26	.108	216		200		43.3	48.5	40.0	45	110	220
6 Lubricating oils.....	Bulk.....				7.60	.132	263	295		7.02						
	55-gal drums ³	455	11.2	12	8.70	.115	230		177		4.40	4.92	3.33	4	11	20
	5-gal drums ⁴	49.2	.95	1	9.76	.103	205		200		40.7	45.5	40.0	40	100	200
	1 qt cans (12 per case).....	34.5	.88	1							58.0	64.9	40.0	60	145	290
	1 qt cans (24 per case).....	60	1.6	2							33.4	37.3	20.0	35	90	170
	5 qt cans (6 per case).....	77	1.9	2							26.0	29.1	20.0	25	65	130
7 Greases.....	25-lb pails.....	29	.95	1							69.0	77.2	40.0	70	170	335
	5-lb cans (6 per case).....	44	1.1	2							45.4	50.9	20.0	45	115	225

¹ For ocean shipping, storage, and pipeline computations, bulk petroleum products usually are measured in barrels of 42 gallons each, or in long tons.

² Based upon authorized loads in short tons. When overloads are authorized, these quantities may be increased to the cubic capacity of the vehicles or to 100 percent overweight, whichever limit is reached first.

³ Drums, 55-gallon, normally are filled to 53 gallons to allow for expansion. Drums, 18-gage weight, approximately 51 pounds empty.

⁴ For planning purposes, weight of gasoline may be taken as 42 pounds and weight of lubricating oil for motors as 50 pounds per 5-gallon drum, including weight of the drum. Drums, 5-gallon, weight approximately 11 pounds empty.

95. Estimating Class III Requirements

a. *Estimating Solid Fuel Requirements.* The factors given below are based on the use of coal only, assuming use of no petroleum products or gas. When firewood or peat is substituted, 2 pounds of such fuel is required in lieu of 1 pound of coal. Factors applicable to temperate climate:

(1) *Utilities.*

Space, water heating and cooking, per man per day	4 lb
Cooking, only, per man per day	1.5 lb
Hospital use, per bed per day:	
Winter	12 lb
Summer	5 lb
Forge, per day per unit	6 lb
Railroad engine, per mile of travel on flat to hilly terrain	100 lb
Coffee roaster, per day per unit	400 lb
Laundry, fixed, per day per unit	32 short tons

(2) *Steam locomotives (coal burning).*

	1	2	3	4
1	Type of locomotive	Type of operation	Estimated average rate of coal consumption	
			Pounds/ train mile	Pounds/ hour
2	2-8-2 standard gage	Road	100	750
3	2-8-0 standard gage	Road	90	700
4	2-8-2 narrow gage	Road	100	750
5	0-6-0 standard gage	Switch	75	500
6	0-6-0 narrow gage	Switch	75	500

In estimating coal requirements, it is recommended 10 percent be added to computed rate of consumption to allow for contingencies.

For general planning purposes, assume operation of switch engines for 20 hours/day, allowing 4 hours/day for maintenance.

b. *Estimating Gasoline Requirements.* The major factors controlling gasoline requirements in military operations are—

- (1) *Displacement.* By measuring the distance that the center of mass is moved, the average mileage moved by each vehicle is determined. Administrative or march movements are computed on the basis of using available road nets. Movements under battle conditions are computed on the basis of selected elements of the organization proceeding cross country. Experience tables provide consumption data on a mileage basis for moving an organization. For planning purposes, it is assumed that cross country battle consumption

is at a rate of 2.5 times that given for road movements in the gasoline and oil supply data tables (pars. 96-102).

- (2) *Supply.* Certain vehicles of the organization must make round-trip supply movements. Since these movements generally are made to supply points positioned at varying distances from the location of the organization, an average round-trip supply distance must be determined. Experience has shown that daily requirements for supply operations are approximately equal to 20 percent of the total organizational consumption per mile of displacement multiplied by the average round-trip supply distance. When the organization is not on the move, supply operation requirements are included in the composite requirement described in (4) below and are not computed separately.
- (3) *Service.* Supplemental daily requirements exist for such purposes as movement of vehicles within bivouac areas and on reconnaissance, warming up engines, and abnormal periods of low-gear operation. These items will differ with the character of the operation, weather, roads and terrain, and must be estimated in accordance with general conditions. Under average conditions, these requirements can be estimated by using the consumption necessary to move all vehicles in the organization ten miles over roads. This factor applies when the organization is on the march or in combat.
- (4) *Housekeeping.* Additional daily requirements exist for administrative vehicles, kitchens, gasoline-powered equipment and maintenance and testing of engines. When the organization is not on the march, these requirements are grouped in a composite daily requirement as noted under each gasoline and oil supply data table. When the organization is on the move, the requirements for administrative vehicles and gasoline-powered equipment are absorbed by displacement requirements; the maintenance and testing factor is absorbed by the service factor; but the kitchen requirement must be added on the basis of a daily consumption per kitchen of 15 gallons of gasoline.
- (5) *Wastage.* This factor covers evaporation, spillage, and small combat losses. It is applied only to road movement in the combat zone. It is computed as 10 percent of the sum of all other consumption figures.

Caution: Refer to notes at foot of gasoline and oil supply data tables (pars. 96-102) for supplemental information and

data necessary to determine complete solutions of estimated requirements.

Example: An armored division (par. 97) is to make the following movement: 1st day—90 miles in communications zone to bivouac area at rear army boundary; 2d day—no movement; 3d day—60 miles forward in combat zone; and 4th day—10 miles, with 8 miles under cross country battle conditions for all elements except the division trains. Average round trip supply distances are: 1st day—30 miles; 2d day—20 miles; 3d day—40 miles; and 4th day—30 miles. Estimate gasoline requirements for the 4-day period.

1st day		
(a)	Multiply 90 (displacement) by 2,080 (gals per mile).....	= 187, 200
(b)	Multiply 30 (supply distance) by 416 (20% of division consumption per mile).....	= 12, 480
(c)	Multiply 10 by 2,080 to account for service requirements..	= 20, 800
(d)	Multiply 15 (gals) by 97 (organic kitchens).....	= 1, 455
2d day		
(e)	From footnote 1, paragraph 97.....	= 4, 000
3d day		
(f)	Multiply 80 (displacement) by 2,080 (gals per mile).....	= 124, 800
(g)	Multiply 40 (supply distance) by 416 (20% of division consumption per mile).....	= 16, 640
(h)	Multiply 10 by 2,080 to account for service requirements..	= 20, 800
(i)	Multiply 15 (gals) by 97 (organic kitchens).....	= 1, 455
(j)	Take 10% of (f) + (g) + (h) + (i) to account for wastage..	= 16, 370
4th day		
(k)	Multiply 2 (road displacement) by 2,080 (gals per mile)..	= 4, 160
(l)	Multiply 8 (road displacement) by 85 (gals per mile for division trains).....	= 680
(m)	Multiply 8 (cross-country battle displacement) by 1,955 (gal per mile for combat units) by 2.5 (cross-country battle factor).....	= 39, 100
(n)	Multiply 30 (supply distance) by 416 (20% of division consumption per mile).....	= 12, 480
(o)	Multiply 10 by 2,080 to account for service requirements..	= 20, 800
(p)	Multiply 15 (gals) by 97 (organic kitchens).....	= 1, 455
(q)	Take 10% of (k) + (l) + (n) + (o) + (p) to account for wastage.....	= 3, 958
(r)	Total estimate for 4 days—add (a) through (q).....	= 488, 633
		or 488,640 gallons

96. Gasoline and Oil Supply Data—Airborne Division

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirement, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gals.)			Fuel drum data, number of organic 5-gallon fuel drums			Organic kitchens
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease, miscellaneous (lbs.)	Vehicle tanks	Drums 5-gallon	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicle	Total	
Div Trp.....	4,072.6	101.4	158.7	103.8	11,056.5	9,065	20,121.5	1,409	473	1,882	6
Hq Co, Abn Div.....	491.8	13.2	18	13.6	1,332	1,000	2,332	135	65	200	1
Bnd.....						10	10			2	0
Sig Co.....	996	24.8	41.5	25.7	2,719	670	3,389	24	110	134	1
MP Co.....	368.4	11.6	12.6	11.4	981	190	1,171	1	37	38	1
QM Co.....	1,366	30.6	58.8	31.2	3,726	6,740	10,466	1,240	97	1,348	1
QM Preht Maint Co.....	291	4.8	6.7	5.6	739	150	889	7	23	30	1
AT Plat.....	156	3.8	6.6	3.8	435	100	535		20	20	0
Repl Co.....	48	1.2	2	1.2	134	35	169	1	6	7	1
Rcn Co.....	355.4	11.4	12.5	11.3	990.5	170	1,160.5	1	33	34	1
3 Inf Regt (ea).....	10,677	221.6	167.8	114.3	14,034	1,895	5,929	29	833	862	20
Hq and Hq Co.....	324	9	11.1	9.5	804	220	1,084	9	35	44	1
3 Inf Bn (ea).....	396	10.8	13.8	11.4	1,056	265	1,321	5	209	214	5
Hq & Hq Co.....	108	2.8	3.8	3	284	80	364	1	15	16	1
3 Rifle Co (ea).....	30	.8	1.2	.8	84	25	109	1	4	5	1
Hv Wpn Co.....	198	5.6	6.4	6	520	110	630	1	21	22	1
Svc Co.....	1,140	26.2	42.8	24.7	2,861	400	3,261	1	79	80	1
Spt Co.....	372	8.2	12.7	9.5	916	225	1,171	1	50	51	1
Med Co.....	216	5.4	7.5	5.9	558	170	728	2	32	34	1
Tk Co (M).....	7,437	140.4	52.3	30.5	5,607	55	5,722	1	10	11	1
Engr Bn.....	2,450	51.8	107.7	58.4	5,923	1,225	7,148	38	207	245	4
Hq & Hq and Svc Co.....	1,331	28.7	67.5	32.6	3,049	490	3,539	23	75	98	1
3 Engr Co (ea).....	373	7.7	13.4	8.6	958	245	1,203	5	44	49	1

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1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirement, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gals.)			Fuel drum data, number of organic 5-gallon fuel drums			Organic kitchens
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease, miscellaneous (lbs.)	Vehicle tanks	Drums 5-gallon	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicle	Total	
25 Ord Bn.....	2,562	59.4	60.4	53.2	4,956	2,850	7,806	316	254	570	2
26 Hq & Hq Det.....	67	1.8	2.7	1.9	182	60	242	2	10	12	1
27 Ord Co Fwd.....	1,560	37.4	24.9	31.3	2,523	630	3,153	3	123	126	1
28 Ord Co Rear.....	935	20.2	32.8	20.0	2,251	2,160	4,411	311	121	432	1
29 Med Bn.....	991	20.6	34	24	2,379	780	3,159	10	146	156	3
30 Hq & Hq Co.....	229	5.8	9.2	6	625	170	795	2	32	34	1
31 Amb Co.....	438	8	12.2	11	938	395	1,333	1	78	79	1
32 Clr Co.....	324	6.8	12.6	7	816	215	1,031	7	36	43	1
33 Tk Bn (M) (ea).....	26,748	482.2	225.4	144.6	22,732	11,120	33,852	2,090	132	2,222	4
34 Hq, Hq & Svc Co.....	3,076	65.8	53.4	43.8	4,496	10,900	15,396	2,086	92	2,178	1
35 4 Tk Co (M) (ea).....	5,918	104.1	43	25.2	4,559	55	4,614	1	10	11	1
36 Div Arty.....	8,419	190.6	316	210.7	21,993	5,210	27,203	157	884	1,041	25
37 Hq & Hq Btry.....	516	11.8	18.1	13.3	1,300	415	1,715	21	62	83	1
38 3 FA Bn, 105-mm How (ea).....	1,675	37.6	63.2	40.5	4,342	975	5,317	25	170	195	5
39 Hq & Hq Btry.....	348	8.2	11.7	9.3	870	335	1,205	21	46	67	1
40 Svc Btry.....	409	9	16.1	9	1,084	175	1,259	1	34	35	1
41 3 FA Btry (ea).....	306	6.8	11.8	7.4	796	155	951	1	30	31	1
42 FA Bn, 155-mm How.....	1,846	42.2	65.7	51.3	4,868	1,270	6,138	57	197	254	5
43 Hq & Hq Btry.....	270	6.2	8.8	7.2	661	400	1,061	21	59	80	1
44 Svc Btry.....	409	9	16.1	9	1,084	255	1,339	3	48	51	1
45 3 FA Btry (ea).....	389	9	13.6	11.7	1,041	205	1,246	11	30	41	1
46 AAA Bn.....	1,032	23.8	42.6	24.6	2,799	600	3,399	4	115	119	4
47 Hq & Hq Btry.....	240	5.8	9.6	6.0	651	145	796	1	28	29	1
48 3 AAA AW Btry (ea).....	264	6	11	6.2	716	150	866	1	29	30	1
49 Total.....	77,273.6	1,570.8	1,405.6	987.6	111,141.5	35,940	147,081.5	4,107	4,595	8,702	104

97. Gasoline and Oil Supply—Armored Division 1 2 3 4 5 6

1	1	2	3	4	5	6	7	8	9	10	11	12
	Unit	Fuel and lubricant requirement, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gal.)			Fuel drum data, number of organic 5-gallon fuel drums			Organic kitchens
		Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease, miscellaneous (lbs.)	Vehicle tanks	Drums 5-gallon	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicles	Total	
2	Hq Co, Armd Div.....	1,201	29.5	27	27.9	2,243	1,440	3,683	241	47	288	
3	3 Hq & Hq Cos, CC (ea).....	966	22.7	10.6	21	1,483	445	1,928	04	25	89	
4	Sig Co.....	1,453	32.2	48.1	35.5	3,472	1,590	5,062	226	92	313	
5	MP Co.....	380.4	12	13.4	11.8	1,031	295	1,326	9	50	59	
6	Recon Bn.....	8,834	213.1	112.3	175.9	11,783	5,895	17,678	1,045	134	1,179	
7	Hq, Hq & Sv Co.....	1,428	33.5	29.5	30.3	2,475	5,255	7,730	1,017	34	1,051	
8	4 Recon Cos (ea).....	1,854	44.9	20.7	36.4	2,327	160	2,487	7	25	32	
9	Armd Engr Bn.....	7,309	131	141.9	139.4	12,710	5,255	17,965	842	209	1,051	
10	Hq, Hq & Sv Co.....	1,001	19	55	22.5	2,195	3,435	5,630	630	51	687	
11	Bridge Co.....	1,592	40	42.9	44.1	3,651	1,080	4,731	158	58	216	
12	4 Engr Cos (ea).....	1,179	13	11	18.2	1,716	185	1,901	12	25	37	
13	3 M Tk Bns (ea).....	24,910	449	211.7	143.4	21,015	11,105	32,720	2,127	94	2,221	
14	Hq, Hq & Sv Co.....	3,598	73.4	53.7	50.6	5,099	10,905	16,004	2,107	86	2,193	
15	4 M Tk Cos (ea).....	5,328	93.9	39	23.2	4,129	35	4,164	5	2	7	
16	Hv Tk Bn.....	27,757	437.6	164.4	243.1	25,213	11,140	36,353	2,152	76	2,228	
17	Hq, Hq & Sv Co.....	3,580	70.4	52.5	58.6	5,212	10,975	16,187	2,128	70	2,195	
18	3 Hv Tk Cos (ea).....	8,057	122.4	37.3	61.5	6,607	55	6,722	9	2	11	
19	4 Armd Inf Bns (ea).....	11,139	188.6	46.4	180.4	12,920	5,390	18,310	1,001	77	1,078	
20	Hq, Hq & Sv Co.....	2,139	46.2	30.8	42	3,208	5,210	8,478	989	53	1,042	
21	4 Rifle Cos (ea).....	2,250	35.6	3.9	36.1	2,413	45	2,458	3	6	9	
22	Div Arty.....	30,362	688.5	552.2	704.4	44,835	21,055	65,890	3,073	538	4,211	
23	Hq & Hq Btry.....	912	19.2	24.7	22.5	1,951	415	2,366	29	54	83	
24	3 FA Bus, 105-mm How, SP, Armd (ea).....	5,855	123.3	103.1	124.7	8,680	4,575	13,255	808	107	915	
25	Hq & Hq Btry.....	1,266	23.6	17.3	26.1	1,989	290	2,279	20	33	58	
26	3 FA Btrys (ea).....	1,176	26.8	20.7	27.3	1,656	90	1,746	5	13	18	
27	Sv Btry.....	1,061	19.3	23.7	16.7	1,723	4,015	5,738	773	30	803	
28	FA Bn, 155-mm How, SP, Armd.....	5,550	144.5	114.7	124.7	8,627	4,540	13,167	819	89	908	
29	Hq & Hq Btry.....	790	16	16.3	18.9	1,459	285	1,744	28	29	57	
30	3 FA Btrys (ea).....	1,314	36.4	24.9	29.7	1,815	80	1,895	6	10	16	
31	Sv Btry.....	818	19.3	23.7	16.7	1,723	4,015	5,738	773	30	803	

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	1	2	3	4	5	6	7	8	9	10	11	12
	Unit	Fuel and lubricant requirement, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gals.)			Fuel drum data, number of organic 5-gallon fuel drums			Organic kitchens
		Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease, miscellaneous (lbs.)	Vehicle tanks	Drums 5-gallon	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicle	Total	
32	AAA AW Bn, SP.....	6,335	154.9	103.5	183.1	8,217	2,375	10,592	401	74	475	5
33	Hq & Hq Btry.....	639	15.7	21.1	14.3	1,513	1,995	3,508	365	34	399	1
34	4 AW Btrys (ea).....	1,424	34.8	20.6	42.2	1,676	95	1,771	9	10	19	1
35	Div Trains.....	8,517.8	188.4	309.6	188.1	21,496	6,875	28,371	7,435	525	7,960	13
36	Hq & Hq Co.....	437.8	10.4	16.6	11.0	1,156	625	1,781	88	37	125	1
37	Band.....						10	10	2		2	
38	Repl Co.....	48	1.2	2	1.2	134	35	169	3	4	7	1
39	QM Bn.....	2,384	53.6	100.7	53.7	6,513	1,355	7,868	6,092	144	6,236	3
40	Hq & Hq Det.....	78	1.8	2.2	2.2	181	55	236	2	9	11	1
41	Sup Co.....	1,117	25.2	48	24.9	3,080	625	3,705	6,060	65	6,125	1
42	Fld Sv Co.....	1,189	26.6	50.5	26.6	3,252	675	3,927	30	70	100	1
43	Ord Maint Bn.....	4,417	97.2	146.5	91.3	10,698	3,265	13,963	1,033	240	1,273	4
44	Hq & Hq Co.....	1,537	30.6	38.5	27.4	3,147	955	4,102	745	66	811	1
45	3 Maint Cos (ea).....	960	22.2	36	21.3	2,517	770	3,287	96	58	154	1
46	Armd Med Bn.....	1,231	26	43.7	30.9	2,995	1,585	4,580	217	100	317	4
47	Hq & Hq Co.....	307	7.4	12.2	7.8	823	850	1,673	142	28	170	1
48	3 Med Cos (ea).....	308	6.2	10.5	7.7	724	245	969	25	24	49	1
49	Total Armd Div.....	208,079.2	3,901.8	2,239.3	2,764.9	243,757	109,755	353,512	26,200	2,336	28,536	97

¹ When the division is not on the march, 4,000 gallons of fuel per day are required for administrative vehicles, kitchens, and gasoline powered equipment. This figure includes the warmup factor.

² When figured separately, daily gasoline consumption for each kitchen is 15 gallons.

³ For cross-country battle conditions, fuel and lubricant consumption figures are multiplied by 2.5. (The 10% handling factor need not be applied when this factor is used.)

⁴ When tent stove is issued, add 236 drums, 5 gallon, on the basis of 1 drum per ten stove.

⁵ Data contained in the above table is recommended for planning purposes only. The data above are under development and subject to continuing revision.

⁶ Data for Medical Detachments is included in respective Battalion Headquarters, Headquarters and Service Company figures.

98. Gasoline and Oil Supply Data—Infantry Division ^{1 2 3 4}

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirement, motor vehicles consumption in moving unit 100 miles	Gasoline capacity (gals.)			Fuel drum data, number of organic 5-gallon fuel drums			Organic kitchens			
		Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease, miscellaneous (lbs.)	Vehicle tanks	Drums 5-gallon	Total		Resupply, kitchen, airplane, and miscellaneous	Motor vehicles	Total
2	Hq & Hq Co, Inf Div.....	497.8	18.2	18.1	13.7	1,339	885	2,224	101	76	177	3
3	Band.....						10	10	2		2	
4	MP Co.....	368.4	11.6	12.6	11.4	981	295	1,270	3	56	59	1
5	Ord Bn.....	2,562	40.4	65.6	40.0	4,956	2,850	7,806	316	254	570	2
6	Hq & Hq Det.....	67	1.8	2.7	1.9	182	60	242	2	10	12	
7	Ord Co, Fwd.....	1,560	37.4	24.9	31.3	2,523	630	3,153	3	123	126	1
8	Ord Co, Rear.....	935	20.2	32.8	20	2,251	2,160	4,411	311	121	432	1
9	QM Co.....	1,366	30.6	58.8	31.2	3,720	7,210	10,936	1,184	158	1,442	1
10	Recon Co.....	1,878	45.5	21.7	37	2,394	145	2,539	1	28	29	1
11	Repl Co.....	48	1.2	2	1.2	134	45	179	3	6	9	1
12	Sig Co.....	1,084	25.4	42.8	27.2	2,869	1,245	4,114	104	145	249	2
13	Med Bn.....	967	20.6	34	24	2,379	1,180	3,559	119	137	256	3
14	Hq & Hq Co.....	229	5.8	9.2	6	625	270	895	23	31	54	1
15	Amb Co.....	438	8	12.2	11	938	360	1,298	2	70	72	1
16	Clr Co.....	300	6.8	12.6	7	816	650	1,460	94	30	130	1
17	3 Inf Regts (ea).....	10,313	209.3	174.6	121	14,343	5,665	20,008	682	451	1,133	20
18	Hq & Hq Co.....	402	11	13.7	11.7	1,064	420	1,484	22	62	84	1
19	Hv Mort Co.....	324	6.8	10	8.4	754	255	1,009	1	50	51	1
20	Tk Co (M).....	6,827	120.2	49.8	29	5,272	55	5,327	1	10	11	1
21	Med Co.....	216	5.4	7.5	5.9	558	220	778	12	32	44	1
22	Svc Co.....	1,140	26.3	43.2	25.2	2,861	3,695	6,556	625	114	739	1
23	3 Inf Bns (ea).....	468	13.2	16.8	13.6	1,278	340	1,618	7	61	68	5
24	Hq & Hq Co.....	156	4.2	5.9	4.3	428	125	553	3	22	25	1

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1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirement, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gals.)			Fuel drum data, number of organic 5-gallon fuel drums			Organic kitchens
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease, miscellaneous (lbs.)	Vehicle tanks	Drums 5-gallon	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicle	Total	
3 Inf Regts (ea)—Continued											
25 Hq Wpns Co.....	188	5.4	6.1	5.7	496	110	606	1	21	22	1
26 3 Rifle Cos (ea).....	42	1.2	1.6	1.2	118	35	153	1	6	7	1
27 Tk Bn (M).....	24,256	438.4	210.2	135.1	20,862	11,230	32,092	2,092	155	2,247	5
28 Hq & Hq Svc Co.....	2,944	62.8	54.2	42.3	4,346	11,015	15,361	2,088	115	2,203	1
29 4 Tk Cos (ea).....	5,328	93.9	39	23.2	4,129	55	4,184	1	10	11	1
30 Engr Bn.....	2,906	69.9	131.4	76	7,665	2,345	10,010	112	357	469	5
31 Hq & Hq & Sv Co.....	1,378	30.3	69.4	34.4	3,281	990	4,271	54	144	198	1
32 4 Engr Cos (ea).....	382	9.9	15.5	10.4	1,096	330	1,426	14	52	66	1
33 Div Arty.....	14,789	361.4	400.2	406.8	28,486	11,925	40,411	1,102	1,283	2,385	26
34 Hq & Hq Btry.....	618	14	21.8	15.8	1,556	515	2,071	45	58	103	1
35 3 FA Bns, 105-mm How (ea).....	1,762	39.8	67.3	43.3	4,567	1,965	6,532	162	231	393	5
36 Hq & Hq Btry.....	402	9.6	13.6	10.8	1,012	420	1,432	26	58	84	1
37 3 FA Btrys (ea).....	312	7	12	7.6	813	210	1,023	1	41	42	1
38 Svc Btry.....	424	9.2	17.7	9.7	1,116	900	2,016	130	50	180	1
39 FA Bn, 155-mm How.....	2,634	75.1	85.6	80	5,246	2,685	7,931	161	376	537	5
40 Hq & Hq Btry.....	318	7.2	10.4	8.4	776	365	1,141	25	48	73	1
41 3 FA Btrys (ea).....	614	18.8	18.8	19.9	1,078	450	1,528	2	88	90	1
42 Svc Btry.....	483	11.5	18.8	11.9	1,236	970	2,206	130	64	194	1
43 AAA AW Bn.....	6,251	152.9	99.9	181.1	7,983	2,403	10,386	358	128	486	5
44 Hq & Hq Btry.....	555	13.7	17.5	12.3	1,279	2,000	3,369	354	64	418	1
45 4 AW Btrys (ea).....	1,424	34.8	20.6	42.2	1,676	85	1,761	1	16	17	1
46 --- Total—Inf Div.....	81,661.2	1,686.1	1,530.2	1,166.6	118,820	56,460	175,280	7,285	4,008	11,293	110

¹ When the division is not on the march, 4,000 gallons of fuel per day are required for administrative vehicles, kitchens, and gasoline-powered equipment. This figure includes wastage and warmup factors.

² When figured separately, daily gasoline consumption per kitchen is 15 gallons.

³ For cross country battle conditions, vehicle fuel and lubricant consumption figures are multiplied by 2.5. (The 10 percent wastage factors need not be applied when this factor is used.)

⁴ Includes allowances for tent stoves.

99. Gasoline and Oil Supply Data—Armored Units ^{1 2 3 4}

1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirement, motor vehicles consumption in moving unit 100 miles				Gasoline capacity (gals.)			Fuel drum data number of organic 5-gallon fuel drums			Organic kitchens
	Vehicle fuel (gal.)	Engine oil (gal.)	Gear lubrication (lbs.)	Grease, miscellaneous (lbs.)	Vehicle tanks	Drums 5-gallon	Total	Resupply, kitchen, airplane, and miscellaneous	Motor vehicles	Total	
Hq & Hq Co, Armd Gp.....	174	4.4	6.9	4.5	477	390	867	45	13	58	1
Tk Bn (Hv) (Non-div).....	26,865	423.8	164.2	228.7	24,307	11,140	35,447	2,152	76	2,228	-----
Armd Cav Regt.....	42,112	902.5	559.8	599.6	40,192	42,390	91,582	8,111	367	8,478	20
Hq & Hq Co.....	1,194	23.1	26.4	26.4	2,118	1,290	3,408	177	81	258	1
Svc Co.....	2,350	54.8	126.3	42.2	5,053	38,505	43,558	7,613	83	7,701	1
3 Recon Bne (ea).....	12,856	273.2	135.7	177	14,007	865	14,872	51	122	173	6
Hq & Hq Co.....	802	18.2	14.3	17.7	1,275	260	1,535	23	29	52	1
3 Recon Cos (ea).....	1,854	44.9	20.7	36.4	2,327	160	2,487	7	25	32	1
Tk Co.....	5,328	93.9	39	23.2	4,129	35	4,164	2	5	7	1
How Co.....	1,164	26.4	20.3	26.9	1,622	90	1,712	5	13	18	1
Amph Tk Bn.....	6,587	319.2	148.1	270.4	10,476	690	11,166	10	128	138	5
Hq & Hq Svc Co.....	1,267	46	31.3	48.8	2,240	170	2,410	2	32	34	1
4 Amph Tk Cos (ea).....	1,330	54.8	29.2	55.4	2,059	130	2,189	2	24	26	1
Amph Trac Bn.....	8,319	315.1	185.2	348.8	13,085	815	13,900	14	149	163	3
Hq, Hq & Svc Co.....	1,047	36.5	26.6	39.6	1,905	215	2,120	2	41	43	1
2 Amph Trac Cos (ea).....	3,636	139.3	79.3	154.6	5,590	300	5,890	6	54	60	1
Armd Cav Recon Bn.....	11,735	256.2	136.4	159.8	12,939	5,895	18,834	1,045	134	1,179	5

¹ Refer to paragraph 99d.

² For kitchens, estimated daily requirement, 15 gallons.

³ Data contained in above table is recommended for planning purposes only. The

data are under development and subject to continuing revision.

⁴ Data for Medical Detachments is included in respective Headquarters, Headquarters and Service Company.

100. Gasoline and Oil Supply Data—Artillery Units

a. Field Artillery ^{1 2 3} (nondivisional).

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1	2	3	4	5	6	7	8	9	10	11	12
Unit	Fuel and lubricant requirements—motor vehicles										Organic kitchens
	Consumption in moving unit 100 miles				Gasoline capacity—gallons fuel to fill tanks			Fuel can data—organic fuel drums			
	Vehicle fuel (gal)	Engine oil (gal)	Gear lubricant (lb)	Grease miscellaneous (lb)	Vehicle tanks	Drums 5-gallon	Total	Aircraft kitchens and miscellaneous	Motor vehicle	Total	
Hq & Hq Btry, Corps Arty.....	570	12.8	19.5	14.7	1,413	655	2,068	50	81	131	
Hq & Hq Btry, FA Gp.....	330	7.6	11.4	8.6	828	375	1,203	27	48	75	
FA Obsn Bn.....	2,122	49.8	77.2	54.9	5,427	1,725	7,152	7	338	345	
FA Bn, Pk, 75-mm How.....	282	6.6	11.3	6.9	758	395	1,153	47	32	79	
FA Bn, 105-mm How Towed.....	1,669	36.8	63	39.9	4,304	1,910	6,214	164	218	382	
Armd FA Bn, 105-mm How, SP.....	3,164	66.3	73.3	76.3	6,090	4,530	10,620	769	137	906	
FA Bn, 155-mm How, Towed.....	2,670	75.9	86.9	80.9	5,337	2,725	8,062	164	381	545	
Armd FA Bn, 155-mm How, SP.....	5,586	145.3	116	125.6	8,718	4,540	13,258	763	145	908	
FA Bn, Hv, Towed 155-mm Gun or 8-in How.....	3,121	80.4	66.9	77.2	7,487	4,365	11,852	485	388	873	
FA Bn, Hv, SP 155-mm Gun or How 8-in.....	4,139	98	69.2	76.8	7,464	3,645	11,109	487	242	729	
FA Bn, VH, Towed 240-mm How or 8-in Gun.....	5,459	64.4	63.2	57.6	6,864	4,125	10,989	532	293	825	
Rocket FA Bn, Towed 4.5-in.....	1,687	37.2	65	39.9	4,390	1,120	5,510	4	220	224	
FA Btry Slt.....	384	10.2	19.3	10.9	1,072	405	1,477	5	76	81	
FA Bn, 280-mm Gun.....	3,418	51.4	75.8	50.2	7,397	(2)	(2)	(2)	(2)	(2)	(2)
Arty Rocket Btry.....	891	21	30.2	24.9	2,246	(2)	(2)	(2)	(2)	(2)	(2)

¹ Does not include consumption of oil, gear lub and grease for transporter, hv arty. Does not include diesel tractors.² Data not available.¹ When experience factors are not available, use 400 gallons fuel per day for miscellaneous small fuel-consuming devices.² Includes medical detachment.³ Average daily gasoline consumption (net) is 15 gallons per kitchen.

b. *Antiaircraft Artillery*^{1 2 3} (nondivisional).

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements—motor vehicles									Organic kitchens	
		Consumption in moving unit 100 miles				Gasoline capacity—gallons fuel to fill tanks			Fuel can data—organic fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubrica- tion (lb)	Grease miscella- neous (lb)	Vehicle tanks	Drums 5-gallon	Total	Aircraft kitchens and mis- cellaneous	Motor vehicle		Total
2	AAA Opn Det.....	126	2.8	5	3	332	110	442	6	16	22	1
3	Hq & Hq Btry AAA Gp.....	282.8	6.6	11	7	745	235	980	10	37	47	1
4	AAA Gun Bn, 90-mm.....	2,672.8	103.8	100.2	94.3	8,730	1,400	10,130	31	249	280	5
5	AAA AW Bn, Mbl.....	2,329	51	94	53.7	6,171	1,795	7,966	70	289	359	5
6	AAA Bn, L, 75-mm Gun, Mbl.....	3,433	96	69.6	81.6	6,956	1,560	8,516	27	285	312	4
7	AAA Bn, AW, SP.....	6,371	155.7	104.8	184	8,308	2,470	10,778	361	133	494	5
8	Hq & Hq Btry, AAA Brig.....	319.8	7.8	13.2	8.0	871	275	1,146	14	41	55	1
9	AAA Gun Bn, 120-mm.....	2,566.8	34.6	41.8	32.4	3,898	795	4,693	32	127	159	5
10	AAA Bn, AW, SmbL.....	799	18.6	29.2	19.7	2,073	855	2,928	66	105	171	5
11	AAA Msl Bn.....	815.8	16.6	28.2	17.8	2,014	(*)	(*)	(*)	(*)	(*)	(*)

*Data not available.

¹ Fuel for operations of generators, etc., must be computed separately.² Includes medical detachment.³ Average daily gasoline consumption (net) is 15 gallons per kitchen.

101. Gasoline and Oil Supply Data—Chemical Units

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	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements—motor vehicles										Organic kitchens
		Consumption in moving unit 100 miles				Gasoline capacity—gallons fuel to fill tanks			Fuel drum data—organic fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubri- cant (lb)	Grease miscella- neous (lb)	Vehicle tanks	Drums 5-gallon (all)	Total	Kitchens and mis- cellaneous	Motor vehicle	Total	
2	Cml Depot Co.....	291	5.8	10.8	6.4	560	155	715	5	26	31	
3	Cml Maint Co.....	182	4.2	4.9	4.2	415	115	530	1	22	23	
4	Cml Decon Co.....	337	7.6	14.4	7.6	740	220	960	3	41	44	
5	Cml Smoke Genr Bn											
6	Hq & Hq Det.....	(57)	(1.1)	(1.8)	(1.4)	(130)	(55)	(185)	(3)	(8)	(11)	-----
7	Cml Smoke Genr Co.....	(522)	(13)	(19)	(13)	(1, 155)	(2, 750)	(3, 905)	(482)	(67)	(559)	
8	Hq & Hq Co, Cml Gp (Fld).....	66	1.7	2.1	1.7	145	55	200	4	7	11	-----
9	Hq & Hq Co, Cml Bn (Sve).....	59	1.5	1.9	1.5	130	50	180	4	6	10	-----

102. Gasoline and Oil Supply Data—Selected Services Units*

	1	2	3	4	5	6	7	8	9	10	11	12
1	Unit	Fuel and lubricant requirements—motor vehicles									Organic kitchens	
		Consumption in moving unit 100 miles				Gasoline capacity—gallons fuel to fill tanks			Fuel can data—organic fuel drums			
		Vehicle fuel (gal)	Engine oil (gal)	Gear lubri- cant (lb)	Grease miscella- neous (lb)	Vehicle tanks	Drums 5-gallon	Total	Aircraft kitchens and mis- cellaneous	Motor vehicle		Total
2	Engr Dp Trk Co.....	2,050	31.0	61.4	41.6	3,180	575	3,755	5	110	115	1
3	Engr Panel Brg Co.....	1,090	23.4	43.4	23.6	2,340	645	2,985	8	121	129	1
4	Engr Ponton Brg Co.....	1,945	37.5	69.6	40	3,755	1,110	4,865	13	209	222	1
5	Engr Fltg Brg Co.....	2,525	54.1	63.6	58	4,840	1,370	6,210	18	256	274	1
6	Med Amb Co (Sep).....	455	11	12.2	11	1,080	370	1,450	4	70	74	1
7	Trans Amph Trk Co.....	915	28.9	43	17.9	2,100	580	2,680	9	107	116	1
8	Trans Trk Co.....	985	21.9	42.5	22.1	2,165	1,135	3,300	16	211	227	1
9	Trans Hv Trk Co.....	1,625	31.8	61.3	41.5	3,165	2,045	5,210	6	403	409	1
10	Hq & Hq Co Trans Trk Bn.....	160	3.7	4.8	3.8	370	140	510	10	18	28	1
11	Hq & Hq Co QM Gp.....	85	2.1	2.0	2.1	85	95	180	8	11	19	1

*Average daily gasoline consumption (net) is 15 gallons per kitchen.

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Section V. CLASS V SUPPLY

103. Definitions and Responsibilities

a. Basic Load. A basic load of ammunition is a prescribed allowance of ammunition authorized to be in possession of a unit. It is expressed in terms of rounds for ammunition fired by weapons and in other units of measure for bulk allotment items. It includes ammunition carried by the individual soldier, the ammunition stowed in self-propelled weapons, the ammunition carried in prime movers and in unit trains. It is established by the Department of the Army based on recommendations of theater commanders. In wartime, it is normally requisitioned by and issued to all units located in an active theater, and such other units as may be specifically directed by the Department of the Army. In peacetime it is normally requisitioned by and issued to those units specifically designated by the Department of the Army. The basic load of ammunition is not necessarily loaded on transport at all times but may be stowed at gun positions or stored in dumps. The composition of the basic load of ammunition, including fuzes, by type will, in general, be as established by SB 38-26. However, this proportion of type may be varied by Army commanders and unit commanders, based on assigned missions, and/will be supplied so far as availability will permit. Bulk allotment items included in the basic load are listed in SB 38-26. The data for basic loads, as shown in the tables, provides the basis for instruction in all Department of the Army schools, to the exclusion of all other similar data. Under no circumstances will the average 50 percent overload of vehicles be used as a vehicle loading guide.

b. Available Supply Rate. The available supply rate is the rate of consumption of ammunition that can be sustained with available supplies, announced by each commander and applicable within his command. For ammunition items fired from weapons, this rate is expressed in rounds per weapon per day. For bulk allotment items such as antitank mines, hand grenades, and demolition explosives, the rate is expressed in terms of units of measure (ea, lb) by organization, individual, or vehicle per day. It is flexible to conform to changing operational plans and commitments and changing tactical conditions. It is used as a control within a unit on the amount of ammunition that may be expended by that unit. At army group and army level, the term is also used as a forecast of ammunition availability. The available supply rate is computed on, and applied to, tactical weapons only; that is, the weapons in divisions, and the crew-served weapons in nondivisional tactical units. Weapons in combat service support units and service support units are excluded unless unusual circumstances necessitate their employment in a combat role.

c. Supply to Units Within Combat Zone. The efficient operation of the ammunition supply system in the combat zone depends upon the maintenance of basic loads, by drawing ammunition from the depot or supply point designated to support the unit. Maintenance of the basic load is the responsibility of the unit commander. The supply installations supporting the unit will fill transportation orders received bearing the statement: "Required to Replenish Basic Load (or Required for Immediate Consumption): Expenditures Are Within Authorized Available Supply Rate." When an ammunition supply point is unable to fill transportation orders, the supply point commander reports that fact promptly to the army ammunition supply officer, requests instructions as to where the ammunition can be obtained, and instructs the unit ammunition representative accordingly.

d. Ground Ammunition Day of Supply. The ground ammunition day of supply is the estimated quantity of ammunition required per day to sustain operations in an active theater in wartime. It is expressed in terms of rounds per weapon per day for ammunition items fired by weapons, and in terms of other units of measure for bulk allotment and other ammunition items. It is used by the Department of the Army for overall supply planning and supply control purposes and by theater commanders in establishing theater stock levels. The basis is applied to weapons authorized to be in the hands of all troops in the theater, beginning with their arrival in the theater. The ground ammunition day of supply, as established, includes the proportion of types of rounds for each weapon and the proportion of types of fuzes for each of the various types of rounds. The ground ammunition day of supply is contained in SB 38-26. It is for use, initially, in a newly established theater and is the basis for initial stockage of the theater, and for use until such time as experience provides a firm basis for correction. It is applicable to a balanced theater Army command of not less than 150,000 men, and will require evaluation and may require adjustment should the Army command be unbalanced or consist of a lesser number. It is used for detailed current planning and supply purposes and is established for major overseas commands, specifically Europe, Far East, Alaska, Pacific, and Caribbean. It is applicable to currently assigned troop strength and organization. It is established by the Department of the Army in conjunction with appropriate theater commanders. In the event that an established theater becomes active, the ground ammunition day of supply established, and published in the Supply Supplement for that theater, continues in effect until such time as experience determines that revision is required. It is the responsibility of theater commanders, for both new and established theaters, to make continuous studies of ammunition expenditures, and recommend to the De-

partment of the Army necessary changes to established ground ammunition days of supply, in order that planning data will be maintained current. Due consideration will be given to the fact that increases in the ground ammunition day of supply will result in increases in production rates, will require additional manpower and raw materials, and may require additional manufacturing facilities. When a recommended increase must be supported from new procurement, normally a time lag of from 9 months to 12 months occurs between the theater recommendations for the increase and the actual receipt in the theater of operations. Decreases in requirements for ammunition will be promptly reported to the Department of the Army in order that production programs may be adjusted as promptly as possible, with the release of manpower, facilities, and raw materials to other channels.

e. Army Commander. The army commander is responsible for—

- (1) Evaluation of the required supply rates submitted by the Corps and other tactical organizations assigned or attached to the army and submission of a consolidated required supply rate to the army group commander.
- (2) Determination of available supply rates to corps and other tactical organizations assigned or attached to the army.
- (3) Submission of ammunition status reports.
- (4) Recommendation of basic load to suit his mission.
- (5) Maintenance of adequate tactical reserves in army ammunition installations and distribution of ammunition within the army area.
- (6) Calling forward ammunition from the communications zone to replenish withdrawals from army ammunition installations.
- (7) Enforcement of supply economy.

f. Corps, Division, and Other Tactical Unit Commanders. Corps, division, and other tactical unit commanders are responsible for—

- (1) Evaluation of the required supply rates submitted by subordinate tactical commands and submission of a consolidated required supply rate to the next higher tactical commander.
- (2) Determination of the available supply rates based on availability to subordinate tactical commanders.
- (3) Maintenance of basic loads at prescribed level.
- (4) Enforcement of supply economy.

g. Procedures. See FM 9-6, Ordnance Ammunition Service in the Field, and FM 100-10, Field Service Regulations, Administration.

104. Ordnance Ammunition Day of Supply Data—Weapons

Information regarding estimated average quantity of ammunition required per day to sustain operations in an active combat theater is contained in DA Supply Bulletin 38-26, Ammunition Day of Supply (U). Proportion of types of rounds, fuzes, and extra fuzes is included where applicable.

105. Ordnance Ammunition Day of Supply Data

Information regarding estimated average quantity of demolitions, explosives, grenades and pyrotechnics required per division per day to sustain operations in an active combat theater is contained in DA Supply Bulletin 38-26.

106. Basic Data—Chemical Ammunition

Information regarding estimated average quantity of chemical hand grenades, smoke pots, land mines and incendiaries required per organization per day to sustain operations in an active combat theater is contained in DA Supply Bulletins 38-26.

107. Combat Vehicle Ammunition Data

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Armament			Miscellaneous stowage*								Ammunition						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Combat vehicles	Principal weapon	Cal. .30 MG	Cal. .50 MG	Grenades per vehicle	Flares, signal ground per vehicle	Miscellaneous per vehicle	Rounds per vehicle				Ammunition stowage (in rounds per vehicle)				Rounds per vehicle in trains		
							Principal weapon	Cal. .30 MG	Cal. .45 SMG	Cal. .50 MG	Principal weapon	Cal. .30 MG	Cal. .45 SMG	Cal. .50 MG	Principal weapon	Cal. .30 MG	Cal. .50 MG
Car, half-track, M2A1, (TM 9-710) (TM 1710A.).	-----	1	1	10 hand-----	12	14 mines AT.	-----	7,750	540	700	-----	7,750	540	700	-----	0	0
Carriage, Motor, 76-mm Gun M18, (TM 9-755).	Gun 76-mm M1A1C or M1A2.	-----	1	12 hand-----	-----	4 pots, HC, 18 Sig AC.	53	450	-----	-----	45	450	-----	840	-----	-----	0
Carriage, Motor, 105-mm How, M37, (TM 9-717).	How, 105-mm M4.	-----	1	8 hand-----	-----	-----	276	-----	750	990	126	-----	750	990	150	-----	0
Carriage, Motor, 155-mm How., M41, (TM9-744).	155-mm How., M1.	-----	-----	12 hand-----	-----	-----	210	-----	420	-----	22	-----	420	-----	188	-----	0
Carriage, Motor, 155-mm Gun, M40, (TM 9-747).	155-mm Gun M2.	-----	-----	10 rifle, 12 hand.	-----	-----	173	-----	-----	-----	{HE-Fuze Prop Prim	20 25 20 50	-----	-----	153	-----	-----
Carriage, Motor, 8-inch How., M43, (TM 9-747).	8-inch How., M1 or M2.	-----	-----	10 rifle, 12 hand.	-----	-----	148	-----	-----	-----	{HE-Prop Fuze Prim	12 12 25 50	-----	-----	136	-----	-----
Carriage, Motor, Multiple gun M16, (TM 9-710).	4-cal. .50, MG, M2.	-----	-----	10 rifle, 26 hand.	-----	-----	-----	-----	420	7,100	-----	-----	420	5,000	-----	-----	2,100
Carriage, Motor, Twin 40-mm Gun, M19A1, (TM 9-761).	Twin 40 Gun, M2.	-----	-----	10 rifle, 12 hand.	-----	-----	720	-----	480	-----	352	-----	480	-----	368	-----	-----
Carrier, Half-track, Mortar, 81-mm M21, (TM 9-710).	81-Mort, M1	-----	1	12 hand-----	-----	12 mines, AT.	120	-----	600	715	97	-----	600	400	23	-----	315

Carrier, half-track, M9A1. (TM 9-707).		3	1	10 hand		14 mines, AT.		7,750	540	805		7,750	540	700		0	105		
Carrier, personnel, half-track, M3, (TM 9-710).		1		22 hand		24 mines, AT.		4,500	540			4,000	540			500			
Carrier, personnel, half-track, M3A1, (TM 9-710).		1	1	22 hand		24 mines, AT.		7,750	540	805		7,750	540	700		0	105		
Gun, 155-mm, SP, T07 (TM 9-7212).	155-mm Gun		1	8 hand				170	180	945	20		180	945	150		0		
Howitzer, 105-mm, SP, T98, E1, (TM 9-717A).	105-mm, How		1	8 Grenades smoke or frag.				275		945	102		180	945	173		0		
Howitzer, 155-mm, SP, T90, E1, (TM 9-1730B).	155-mm How		1	8 grenades, smoke or frag.				89		945	30		180	945	59		0		
Howitzer, 8-in, SP, T108, (TM 9-7220).	8-inch How., T89.		1	8 hand				148			HE-Prop Fuze Prim 10 10 25 50	10	180	900	138		0		
Tank, Light, M24, (TM 9-729).	75-mm, M6	2	1	8 hand	12			53	4,375	180		530	48	4,125	180	425	5	250	105
Tank, 76-mm Gun, M41 (TM 9-730).	76-mm, T91E3	1	1	8 hand				62	5,475			735	57	5,225		630	5	250	105
Tank, 76-mm Gun, M41E1. (TM 9-730).	76-mm, T91E3		1	8 hand	12			70	5,000			735	60		180	4,630	5		105
Tank, M, M4A1 (75-mm Gun), (TM 9-731AA).	75-mm, M3	2	1	12 hand				114	5,750	600	840	90	4,750	600	630	24	1,000	210	
Tank, M, M4A3 (76-mm Gun).	75-mm, M3	2	1	12 hand				102	5,750	600	825	97	4,750	600	300	5	1,000	525	
Tank, M, M4A3 (105-mm Howitzer).	105-mm How., M4.	2	1	12 hand				79	5,000	900	840	66	4,000	900	630	13	1,000	210	
Tank, M, M4A3E2 (75-mm Gun) (wet) assault.	75-mm Gun, M3.	2	1	12 hand				132	6,500	900	735	104	6,250	900	630	28	250	105	
Tank, M, M4A3E8.	76-mm, M1A2	2	1	12 hand	12			94	6,875	900	735	71	6,875	900	525	23	0	210	
Tank, 90-mm Gun, M26.	00-mm, M3	2	1	12 hand				80	6,000	900	735	70	5,500	900	525	10	500	210	
Tank, 105-mm, How, M45.	105-mm, How	2	1	12 hand				87	5,750	900	760	74	5,500	900	550	13	250	210	
Tank, 90-mm Gun, M46.	00-mm, M3A1	2	1	12 hand	12			80	6,000	180	735	70	5,500	180	525	10	500	210	
Tank, 90-mm Gun, M47.	90-mm, T119	2	1	8 hand	12			87	7,000		3,200	71	6,650	180	3,000	16	350	200	

* Included in base loads.

Armament				Miscellaneous stowage*							Ammunition						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Combat vehicles	Principal weapon	Cal. .30 MG	Cal. .50 MG	Grenades per vehicle	Flares, signal ground per vehicle	Miscellaneous per vehicle	Rounds per vehicle				Ammunition stowage (in rounds per vehicle)				Rounds per vehicle in trains		
							Principal weapon	Cal. .30 MG	Cal. .45 SMG	Cal. .50 MG	Principal weapon	Cal. .30 MG	Cal. .45 SMG	Cal. .50 MG	Principal weapon	Cal. .30 MG	Cal. .50 MG
Tank, 90-mm Gun, M48.	90-mm, M41-----	1	1	8 hand-----	-----	-----	77	6,650	180	605	60	5,900	180	500	17	750	105
Tank, 120-mm Gun, T43E1.	120-mm, T123E1.	2	1	12 hand-----	-----	-----	43	8,850	180	1,105	33	8,850	180	1,000	10	500	105
Vehicle, Landing Tracked, (Unarmored) LVT (4).	-----	2	2	24 hand-----	-----	-----	-----	4,000	-----	5,000	-----	4,000	-----	5,000	-----	0	0
Vehicle, Landing, LVT, (A)(4) Tracked, (Armored) LVT (A) (5).	75-mm How., M2 or M2A1.	3	-----	24 hand-----	6MB	-----	100	6,000	-----	-----	100	6,000	-----	-----	0	0	-----
Vehicle, Armored, Infantry M75 (T18E2).	-----	-----	1	-----	-----	Rocket 3.5 10 rds.	-----	-----	180	1,800	-----	-----	180	1,800	-----	-----	0
Vehicle, Utility, Armored, M39.	-----	-----	1	12 hand-----	-----	4 pot smoke.	-----	-----	-----	900	When P.M. 42 rds. 3 in.	-----	-----	900	-----	-----	0
Vehicle, Armored, Infantry M59.	-----	-----	1	-----	-----	Rocket 3.5 10 rds.	-----	-----	180	1,800	-----	-----	180	1,800	-----	-----	0
Vehicle, Tank, Recovery, M32A1B3.	-----	1	-----	20 hand-----	12	6 pot smoke.	-----	6,250	-----	-----	-----	6,250	-----	-----	-----	-----	-----
Vehicle, Tank, Recovery, M51.	-----	-----	1	20 hand-----	-----	Rocket 3.5, 10 rds 6 pot smoke.	-----	-----	180	1,815	-----	-----	-----	1,500	-----	-----	315
Vehicle, Tank, Recovery, M74.	-----	-----	1	20 hand-----	-----	Rocket 3.5, 10 rds 6 pot smoke.	-----	2,250	-----	1,365	-----	2,000	-----	1,050	-----	250	315

* Included in basic load.

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108. Estimated Expenditures of Ammunition.

a. Ammunition Per Weapon Per Day, Expressed in Rounds.*

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Type of combat													
		Attack of position					Covering and security force-action	Defense of position		Inactive situation	Meeting engagement	Pursuit	Retirement or delaying action	Assault of hostile shore	Protracted period
		Permanent fortification		Deliberately organized		Hastily organized		First day	Succeeding days						
		First day	Succeeding days	First day	Succeeding days										
1	Pistol, cal .45.....	2	1	2	1	1	1	2	1	0.2	1	0.2	0.3	2	0.3
2	Carbino, cal .30.....	6	3	6	3	5	4	8	6	1.0	4	1.0	3.0	5	2.0
3	Rifle, cal .30.....	20	15	20	15	15	15	25	15	5.0	15	3.0	10.0	15	6.0
4	Rifle, automatic, cal .30.....	70	40	65	35	50	40	80	50	15.0	40	8.0	30.0	50	20.0
5	Gun, machine, cal .30.....	170	100	160	90	120	100	200	120	40.0	100	20.0	70.0	120	50.0
6	Gun, submachine, cal .45.....	35	20	35	20	25	20	40	25	8.0	20	4.0	15.0	25	10.0
7	Gun, machine, cal .50 (HB) ¹	50	30	50	30	35	30	60	35	15.0	30	5.0	20.0	35	20.0
8	Mortar, 60-mm.....	17	10	16	9	12	10	20	12	4.0	10	2.0	7.0	12	5.0
9	Mortar, 81-mm.....	70	40	64	35	50	40	80	50	16.0	40	8.0	30.0	50	20.0
10	Mortar, 4.2-in.....	70	40	64	35	50	40	80	50	16.0	40	8.0	30.0	50	20.0
11	Rifle, 57-mm (recoilless).....	10	6	10	6	7	6	12	7	2.0	6	1.0	5.0	7	3.0
12	Rifle, 75-mm (recoilless).....	7	4	7	4	5	4	8	5	2.0	4	1.0	3.0	5	2.0
13	Howitzer, 75-mm.....	85	50	80	45	60	50	100	60	20.0	50	10.0	35.0	60	25.0
14	Howitzer, 105-mm towed or SP.....	150	90	145	80	110	90	180	110	35.0	90	18.0	65.0	110	45.0
15	Howitzer, 105-mm M4 (tank).....	22	12	20	11	15	12	25	15	5.0	12	3.0	8.0	15	6.0
16	Howitzer, 155-mm towed or SP.....	120	70	110	65	85	0	140	85	30.0	70	15.0	50.0	85	35.0
17	Gun, 75-mm tank.....	15	8	13	7	10	8	16	10	3.0	8	2.0	5.0	10	4.0
18	Gun, 76-mm.....	15	8	13	7	10	8	16	10	3.0	8	2.0	5.0	10	4.0
19	Gun, 90-mm tank and antitank.....	22	12	20	11	15	12	25	15	5.0	12	3.0	8.0	15	6.0
20	Gun, 155-mm towed or SP.....	85	50	80	45	60	0	100	60	20.0	50	0.0	0.0	60	25.0
21	Gun, 8-in.....	27	16	25	15	20	0	32	20	7.0	16	0.0	0.0	20	8.0
22	Howitzer, 8-in.....	85	50	80	45	60	0	100	60	20.0	50	0.0	0.0	60	25.0
23	Howitzer, 240-mm.....	50	30	50	30	35	0	60	35	12.0	30	0.0	0.0	35	15.0
24	Launcher, rocket, 2.36-in.....	7	4	7	4	5	4	8	5	2.0	4	1.0	3.0	5	3.0
25	Launcher, rocket, 3.5-in.....	5	3	5	3	3	2	6	4	1.0	2	1.0	2.0	4	1.5

*Figures were derived from a study of World War II experience plus consideration of postwar developments of materiel and reorganization of units. The quantities are representative of actual requirements when applied to units of regimental size or larger.

¹ Multiple mounts will require specified quantities for each barrel.

b. Ammunition Per Type Unit Per Day, Expressed in Tons.

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		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		Type of combat													
		Attack of position					Covering and security force- action	Defense of position		Inactive situation	Meeting engage- ment	Pursuit	Retire- ment or delaying action	Assault of hostile shore	Airborne assault
		Permanent forti- fication		Deliberately or- ganized		Hastily organ- ized		First day	Succeed- ing days						
		First day	Succeed- ing days	First day	Succeed- ing days										
1	Divisional slice.....	850	500	800	450	600	400	1,000	600	200	500	100	350	600	
2	Airborne division.....	466	271	437	249	329	197	545	321	116	267	60	192	333	286
3	Armored division.....	512	297	480	271	361	222	597	366	125	292	66	208	366	-----
4	Infantry division.....	544	317	511	289	386	243	638	390	146	313	69	226	390	-----
5	Corps artillery 155-mm howitzer (per bn).....	121	71	111	66	86	80	142	86	30	71	15	51	86	-----
6	Corps artillery—155-mm gun (per bn).....	69	40	65	36	48	0	81	48	10	40	0	0	48	-----
7	Corps artillery—8-in howitzer (per bn).....	116	68	110	62	82	0	137	82	27	68	0	0	82	-----
8	Army artillery—8-in gun (per bn)...	34	20	31	18	25	0	39	25	9	20	0	0	25	-----
9	Army artillery—240-mm howitzer (per bn).....	71	42	71	42	49	0	84	49	17	42	0	0	49	-----

109. Field Artillery Ammunition Expenditures

a. Expressed in Rounds Per Weapon Per Hour. (These figs. are suitable for computing expenditures for periods of time less than 6 hours.)

1	Kind of fire or phase of action	2	3	4	5
		Average rate per gun per hour			
		105-mm howitzer	155-mm howitzer	155-mm gun—8-in how.	240-mm howitzer— 8-in gun
2	Advance guard action, development, and deployment..	25	12	-----	-----
3	Preparation.....	80	25	25	5
	Supporting fires during the attack (including counter- battery):				
4	First 2 hours.....	50	25	25	5
5	After 2 hours.....	30	15	15	5
6	Exploitation, pursuit, delaying action, or delaying enemy development.....	25	12	12	5
7	Counterpreparation.....	60	25	25	5
8	Defensive fires against infantry attack (including coun- terbattery).....	50	25	25	5
9	Fortified position.....	50	25	25	8

b. Expressed in Tons Per Battalion Per Hour. (These figs. are suitable for computing expenditures for periods of time less than 6 hours.)

1	Kind of fire or phase of action	2	3	4	5
		Average tonnage per battalion per hour			
		105-mm howitzer	155-mm howitzer	155-mm gun	240-mm howitzer
2	Advance guard, action, development, and deployment..	11.02	12.35	-----	-----
3	Preparation.....	35.28	25.87	20.55	6.98
	Supporting fires during the attack (including counter- battery):				
4	First 2 hours.....	22.05	25.87	20.55	6.98
5	After 2 hours.....	13.22	15.52	12.33	6.98
6	Exploitation, pursuit, delaying action, or delaying enemy development.....	11.02	12.42	9.86	6.98
7	Counterpreparation.....	26.46	25.87	20.55	6.98
8	Defensive fires against infantry attack (including counterbattery).....	22.05	25.87	20.55	6.98

110. Ammunition Supply Data—Airborne Division

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	Div HQ & HQ CO, TOE 57-1A & 57-2A, BAND, TOE 12-107, SIG CO, TOE 11-557A; MP CO, TOE 19-97A; REPL CO, TOE 20-7; PRCHT MAINT CO., TOE 10-337A; AT PLAT, TOE 57-19A:							
2	Carbine, cal. .30, M2.....	90	686	61,740	1.019	60	30	-----
3	Gun, machine, cal. .30 (L).....	4,000	3	12,000	.462	-----	4,000	-----
4	Gun, machine, cal. .50, M2.....	530	14	7,420	1.373	-----	530	-----
5	Gun, submachine, cal. .45.....	90	125	11,250	.309	30	60	-----
6	Gun, 90-mm, AT, on carriage, Abn....	105	6	630	20.475	-----	75	30
7	Launcher, Rkt, 3.5-in, M20.....	4	36	144	.675	-----	4	-----
8	Pistol, Auto, cal. .45, M1911A1.....	21	94	1,974	.054	21	-----	-----
9	Rifle, Auto, cal. .30, Browning, M1918A2.....	500	11	5,500	.206	180	320	-----
10	Rifle, US, cal. .30, M1.....	96	477	45,792	1.969	48	48	-----
11	Rifle, 106-mm, M27, on Mt M75.....	20	3	60	2.160	-----	20	-----
12	Grenade, hand.....	-----	-----	750	.794	-----	750	-----
13	Grenade, rifle.....	-----	-----	770	1.115	-----	770	-----
14	Total.....	-----	-----	-----	30.611	-----	-----	-----
	ORD MAINT BN, TOE 9-35:							
15	Carbine, cal. .30, M2.....	90	159	14,310	.236	90	-----	-----
16	Gun, machine, cal. .30, Browning, M1919A4.....	4,000	10	40,000	1.540	-----	4,000	-----
17	Gun, machine, cal. .50, M2.....	530	11	5,830	1.079	-----	530	-----
18	Gun, submachine, cal. .45, M3A1.....	90	50	4,500	.124	90	-----	-----
19	Launcher, Rkt, 3.5-in, M20.....	4	6	24	.113	-----	4	-----
20	Pistol, auto, cal. .45, M1911A1.....	21	7	147	.004	21	-----	-----
21	Rifle, US, cal. .30, M1.....	96	111	10,656	.458	-----	-----	-----
22	Total.....	-----	-----	-----	3.554	-----	-----	-----
	QM CO, TOE 10-17:							
23	Carbine, cal. .30.....	90	149	13,410	.221	90	-----	-----
24	Gun, machine, cal. .50, M2.....	530	11	5,830	1.079	-----	530	-----
25	Gun, submachine, cal. .45.....	90	4	360	.009	60	30	-----
26	Launcher, rocket, 3.5-inch.....	4	5	20	.094	-----	4	-----
27	Pistol, automatic, cal. .45.....	21	3	63	.002	21	-----	-----
28	Rifle, cal. .30, M1.....	96	63	6,048	.260	48	48	-----
29	Grenade, hand.....	-----	-----	200	.212	-----	200	-----
30	Grenade, rifle.....	-----	-----	320	.480	-----	320	-----
31	Total.....	-----	-----	-----	2.357	-----	-----	-----
	RECON CO, AIRBORNE DIV, TOE 57-57:							
32	Carbine, cal. .30.....	90	45	4,050	.067	45	30	15
33	Gun, machine, cal. .30 flex.....	3,000	18	54,000	2.079	-----	1,500	1,500
34	Gun, machine, cal. .50 HB, flex.....	630	3	1,890	.349	-----	525	105
35	Gun, submachine, cal. .45 ^a	100	30	3,000	.083	-----	60	40
36	Launcher, grenade, cal. .30 M7A1 ^b	6	18	108	.160	(12)	(13)	(14)

See footnotes at end of table.

1	Weapon (unit)	2 Rounds per weapon	3 No. of weapons	4 Total basic load		5 How carried		
				Rounds	Tons	Indi- vidual	Vehi- cle	Trains
	RECON CO, AIRBORNE DIV, TOE 57-57—Continued							
37	Launcher, rocket, 3.5-inch.....	14	9	126	.059		12	2
38	Mortar, 81-mm.....	95	3	285	1.382		60	35
39	Pistol, auto, cal. .45.....	21	19	399	.011	21		
40	Rifle, auto, cal. .30.....	1,000	3	3,000	.113	60	480	460
41	Rifle, US, cal. .30.....	120	57	6,840	.294	48	48	24
42	Rifle, 75-mm.....	42	6	252	2.772		34	8
43	Demolition set, Nr 5 ^a (For flares, grenades, etc., and all am- munition for all SNL weapons, see paragraphs 105-107 and 110.)		3	54 lbs.	.030		X	
44	Total.....				7.399			
	ENGR COMBAT BN, ABN DIV, TOE 5-225A:							
45	Carbine, cal. .30.....	90	107	9,630	.159	60		30
46	Gun, machine, cal. .30 (L).....	2,000	18	36,000	1.386		1,000	1,000
47	Gun, machine, cal. .50.....	530	24	12,720	2.353		530	
48	Gun, submachine, cal. .45.....	90	51	4,590	.126	60		30
49	Launcher, rocket, 3.5-inch.....	12	31	372	1.745		6	6
50	Pistol, cal. .45.....	28	7	196	.005	21		7
51	Rifle, cal. .30.....	96	489	46,944	2.019	48		48
52	Explosives 12,140 lbs plus 15 percent for containers.....				6.978			
53	Flare, trip.....			415	1.377			415
54	Grenade, hand.....			1,008	1.218			1,008
55	Grenade, rifle.....			240	.360			240
56	Minc, AP, M3.....			98	.496			98
57	Mine, AT, M6.....			924	7.939		396	528
58	Total.....				26.139			
	Three (3) ABN INF REGT (EA), TOE 7-31:							
59	Carbine, cal. .30.....	90	800	72,000	1.183	60	30	
60	Gun, machine, cal. .30.....	4,500	80	360,000	13.860		3,000	1,500
61	Gun, machine, cal. .50.....	530	60	31,800	5.883		530	
62	Gun, submachine, cal. .45.....	90	37	3,330	.092	60		30
63	Gun, 90-mm.....	135	6	810	26.325		75	60
64	Launcher, rocket, 3.5-inch.....	18	88	1,584	7.429		12	6
65	Mortar, 60-mm.....	72	27	1,944	4.374		36	36
66	Mortar, 81-mm.....	120	12	1,440	6.984		48	72
67	Mortar, 4.2-inch.....	144	8	1,152	19.584		74	70
68	Pistol, cal. .45.....	30	527	15,810	.435	21		7
69	Rifle, Auto, cal. .30.....	740	162	119,880	4.496	60	380	300
70	Rifle, M1 and M1C.....	104	1,789	186,056	8.000	48	24	32
71	Rifle, 57-mm.....	44	27	1,188	4.158		28	16
72	Rifle, 75-mm.....	42	6	252	2.772		34	8
73	Rifle, 106-mm, on mount, recoilless.....	40	18	720	25.920		24	16
74	Flares, trip.....			675	1.763			675
75	Grenade, hand.....			2,419	2.937			2,419
76	Grenade, rifle.....			990	1.483			990
77	Mines, AT, HE, L, M7A1.....			1,000	3.250			1,000
78	Total—one regt.....				140.933			

See footnotes at end of table.

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	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehi- cle	Trains
	ABN DIV ARTY, TOE 6-200A:							
79	Carbine, cal. .30.....	90	1, 186	106, 740	1. 761	60	30	-----
80	Gun, machine, cal. .30, M1919A4, flexible.....	3, 250	42	136, 500	5. 255	-----	1, 000	2, 250
81	Gun, antiaircraft, twin 40-mm (ea)....	264	24	6, 336	20. 909	-----	144	120
82	Gun, machine, cal. .50.....	530	157	83, 210	15. 394	-----	530	-----
83	Gun, CA, cal. .50 (multiple mount 4 guns).....	5, 300	24	127, 200	23. 532	-----	3, 180	2, 120
84	Gun, submachine, cal. .45.....	90	368	33, 120	. 911	45	45	-----
85	Howltzer, 105-mm*.....	250	54	13, 500	330. 750	-----	60	190
86	Howltzer, 155-mm.....	150	18	2, 700	155. 250	-----	50	100
87	Launcher, rocket, 3.5-inch.....	6	245	1, 470	6. 894	-----	6	-----
88	Pistol, cal. .45.....	21	59	1, 239	. 034	21	-----	-----
89	Rifle, US, cal. .30, M1.....	72	1, 448	104, 256	4. 483	48	24	-----
90	Grenade, rifle.....	-----	-----	170	. 260	-----	170	-----
91	Total.....	-----	-----	-----	565. 433	-----	-----	-----
	TK BN (90-mm GUN) TOE 17-25A:							
92	Carbine, cal. .30.....	85	262	22, 270	. 387	45	15	25
93	Gun, machine, cal. .30 Flex.....	3, 250	12	39, 000	1. 502	-----	1, 000	2, 250
94	Gun, machine, cal. .50 HB Flex.....	525	14	7, 350	1. 359	-----	525	-----
95	Gun, submachine, cal. .45*.....	100	156	15, 600	. 429	-----	60	40
96	Launcher, rocket, 3.5-inch.....	9	20	180	. 844	-----	6	3
97	Mortar, 81-mm.....	120	1	120	. 582	-----	97	23
98	Pistol, Auto, cal. .45.....	21	371	7, 791	. 214	21	-----	-----
99	Rifle, Auto, cal. .30.....	1, 500	1	1, 500	. 056	60	480	960
100	Rifle, US, cal. .30 M1.....	120	21	2, 520	. 108	48	48	24
101	Demolition Set #5.....	-----	1	-----	Neg1	-----	X	-----
102	Mines, AT M6A2.....	-----	-----	200	3. 200	-----	-----	200
103	Total.....	-----	-----	-----	8. 661	-----	-----	-----

*Howitzer, 75-mm pack, issued in lieu of 105-mm how when authorized by ZI army commander or theater of operations commander.

For explanation of notes, see paragraph 111.

For total weight of basic load, see paragraph 111d.

111. Ammunition Supply Data—Armored Division—Basic Load

a. Basic Load. The data contained in the tables in *b* below indicate that portion of the basic load of ammunition for the weapons authorized the unit by the appropriate TOE. Additional ammunition required to complete the unit's basic load is dependent upon the type of combat vehicles and the number of each authorized. This additional ammunition may be readily computed by utilizing the information for combat vehicles contained in paragraph 107.

(1) To compute the basic load of ammunition of a unit—

(a) Determine the type of combat vehicles and the number of each in the unit.

- (b) For each type of combat vehicle in the unit, multiply the number of rounds of each type ammunition per vehicle (col. 2 or 3, par. 107) by the number of vehicles in the unit. This determines the ammunition required for the vehicular weapons.
- (c) Next add the amounts of ammunition determined above to the amounts indicated in the appropriate portion of the Table for TOE weapons contained in *b* below. The sum of these figures will give the basic load of ammunition for the unit. Weight of the basic load of ammunition can be determined by using column 7, paragraph 104 which gives weight per round.
- (2) The basic load of Armor units listed in paragraphs 110, 112, or 113 may be computed in the same manner as outlined in (1) above.
- (3) In *c* and *d* below a list is given of the weights of the basic load of ammunition for each type armor unit utilizing specific vehicles as indicated and may be used for planning purposes and supply problems.

b. Ammunition Supply Data—Armored Division^{1 2}

1	2	3	4		5		
			Total basic load		How carried ³		
			Rounds	Tons	Individual	Vehicle ⁴	Trains ⁵
	Weapon (unit)	Rounds per weapon	No. of weapons ^{1 2}				
	HQ, ARMD DIV. TOE 17-1:						
2	Carbine, cal. .30.....	90	126	11,340	0.187	45	45
3	Gun, submachine, cal. .45 ⁶	100	5	500	.014	40	60
4	Pistol, auto, cal. .45.....	21	29	609	.017	21	-----
5	Rifle, US, cal. .30 M1.....	96	45	4,320	.186	48	48
6	Total.....	-----	-----	.404	-----	-----	-----
	HQ CO, ARMD DIV. TOE 17-2:						
7	Carbine, cal. .30.....	90	41	3,690	.061	45	45
8	Gun, machine, cal. .30 Flex.....	2,000	6	12,000	.462	-----	2,000
9	Gun, machine, cal. .50 HB, Flex.....	525	4	2,100	.389	-----	525
10	Gun, submachine, cal. .45.....	100	45	4,500	.124	40	60
11	Launcher, grenade ⁷	10	9	90	.310	-----	10
12	Launcher, rocket, 3.5 inch.....	5	8	40	.188	-----	5
13	Pistol, auto, cal. .45.....	21	19	399	.011	21	-----
14	Rifle, auto, cal. .30.....	1,000	3	3,000	.113	200	800

See footnotes at end of table.

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons ¹	Total basic load		How carried ³		
				Rounds	Tons	Individual	Vehicle ⁴	Trains ⁵
	HQ CO, ARMD DIV, TOE 17-2--Con.							
15	Rifle, U. S., cal. .30.....	96	40	3,840	.165	48	48	-----
16	Rifle, 75mm.....	48	3	144	1.584	-----	48	-----
17	Total.....	-----	-----	-----	3.407	-----	-----	-----
	HQ & HQ CO, COMBAT COM- MAND TOE 17-22A:							
18	Carbine, cal. .30.....	90	55	4,950	.082	45	45	-----
19	Gun, machine, cal. .30 Flex.....	2,000	3	6,000	.232	-----	2,000	-----
20	Gun, machine, cal. .50 HB, Flex.....	525	2	1,050	.194	-----	525	-----
21	Gun, submachine, cal. .45 ⁶	100	29	2,900	.079	40	60	-----
22	Launcher, rocket, 3.5 inch.....	10	9	90	.422	-----	10	-----
23	Pistol, auto, cal. .45.....	21	22	462	.013	21	-----	-----
24	Total.....	-----	-----	-----	1.022	-----	-----	-----
	ARMD SIG CO, TOE 11-57:							
25	Carbine, cal. .30.....	90	208	18,720	.309	45	45	-----
26	Gun, machine, cal. .50 HB, Flex.....	525	8	4,200	.777	-----	525	-----
27	Gun, submachine, cal. .45 ⁶	100	56	5,600	.154	40	60	-----
28	Launcher, rocket, 3.5 inch.....	10	10	100	.469	-----	10	-----
29	Pistol, auto, cal. .45.....	21	14	294	.008	21	-----	-----
30	Rifle, U. S., cal. .30 M1.....	96	84	8,064	.347	48	48	-----
31	Total.....	-----	-----	-----	2.064	-----	-----	-----
	MP CO, ARMD DIV, TOE 19-27:							
32	Carbine, cal. .30.....	90	35	3,150	.052	45	45	-----
33	Gun, machine, cal. .30 Flex.....	2,000	3	6,000	.231	-----	2,000	-----
34	Gun, submachine, cal. .45 ⁶	100	56	5,600	.154	40	60	-----
35	Gun, machine, cal. .50 HB, Flex.....	525	1	525	.097	-----	525	-----
36	Launcher, grenade M7A1.....	5	12	60	.200	-----	5	-----
37	Launcher, rocket, 3.5 inch.....	5	3	15	.070	-----	5	-----
38	Pistol, auto, cal. .45.....	21	105	2,205	.061	21	-----	-----
39	Rifle, U. S., cal. .30.....	96	69	6,624	.285	48	48	-----
40	Total.....	-----	-----	-----	1.150	-----	-----	-----
	HQ & HQ CO, ARMD DIV TRAINS TOE 17-62A:							
41	Carbine, cal. .30.....	90	25	2,250	.037	45	45	-----
42	Gun, machine, cal. .30, Flex.....	2,000	5	10,000	.385	-----	2,000	-----
43	Gun, machine, cal. .50 HB, Flex.....	525	2	1,050	.194	-----	525	-----
44	Gun, submachine, cal. .45.....	100	35	3,500	.096	40	60	-----
45	Launcher, grenade M7A3 ⁷	10	2	20	.070	-----	10	-----
46	Launcher rocket, 3.5 inch.....	10	4	40	.188	-----	10	-----
47	Pistol, auto, cal. .45.....	21	3	63	Neg1	21	-----	-----
48	Rifle, U. S., cal. .30.....	96	17	1,632	.070	48	48	-----
49	Total.....	-----	-----	-----	1.040	-----	-----	-----

See footnotes at end of table.

1	Weapon (unit)	2 Rounds per weapon	3 No. of weapons ^{1, 2}	4 Total basic load		5 How carried ³		
				Rounds	Tons	Indi- vidual	Vehicle ⁴	Trains ⁵
	BAND, ARMD DIV, TOE 12-107:							
50	Carbine, cal. .30.....	90	43	3, 870	.064	90	-----	-----
51	Total.....				.064		-----	-----
	ARMD QM BN, TOE 10-45:							
52	Carbine, cal. .30.....	90	180	16, 200	.267	45	45	-----
53	Gun, machine, cal. .50 HB, Flex.....	525	32	16, 800	3, 108		525	-----
54	Gun, submachine, cal. .45.....	100	21	2, 100	.058	40	60	-----
55	Launcher, rocket, 3.5 inch.....	10	12	120	.563		10	-----
56	Pistol, auto, cal. .45.....	21	5	105	.003	21	-----	-----
57	Rifle, U. S., cal. .30 M1.....	96	125	12, 000	.515	48	48	-----
58	Total.....				4, 515		-----	-----
	ARMD ORD BN, TOE 9-65:							
59	Carbine, cal. .30.....	90	367	33, 030	.545	45	45	-----
60	Gun, machine, cal. .50 HB, Flex.....	525	28	14, 700	2, 719		525	-----
61	Gun, submachine, cal. .45.....	100	69	6, 900	.189	40	60	-----
62	Launcher, rocket, 3.5 inch.....	10	17	170	.797		10	-----
63	Pistol, auto, cal. .45.....	21	10	210	.006	21	-----	-----
64	Rifle, U. S., cal. .30 M1.....	96	237	22, 752	.978	48	48	-----
65	Total.....				5, 234		-----	-----
	REPL CO, ARMD DIV, TOE 20-7:¹⁰							
66	Carbine, cal. .30.....	90	27	2, 430	.040	45	45	-----
67	Gun machine, cal. .50 HB, Flex.....	525	1	525	.097		525	-----
68	Launcher, grenade M7A2 ⁷	5	52	260	.810			¹¹ 5
69	Launcher, rocket, 3.5 inch.....	10	4	40	.188			¹¹ 10
70	Rifle, U. S., cal. .30 M1.....	95	12	1, 152	.049	48	48	-----
71	Total.....				1. 184		-----	-----
	ARMD ENGR BN, TOE 5-215:							
72	Carbine, cal. .30.....	90	143	12, 870	.212	45	15	30
73	Explosives (in demolition sets).....		¹⁰ 16,040		⁹ 8. 020			
74	Gun, machine, cal. .30 Flex.....	2, 000	29	58, 000	2. 333		1, 000	1, 000
75	Gun, machine, cal. .50, HB Flex.....	525	28	14, 700	2. 719		315	210
76	Gun, submachine, cal. .45 ⁶	100	88	8, 800	.242	40	60	-----
77	Launcher, grenade M7A3 ⁷	5	108	540	1. 870		5	-----
78	Launcher, rocket, 3.5 inch.....	10	44	440	2. 064		10	-----
79	Pistol, auto, cal. .45.....	21	7	147	.004	21	-----	-----
80	Rifle, U. S., cal. .30.....	104	663	68, 952	2. 965	56	48	-----
81	Demolition Set No. 1.....		48	(¹⁰)				-----
82	Demolition Set No. 2 ⁹		12	(¹⁰)				-----
83	Demolition Set No. 5.....		36	(¹⁰)				-----
84	Mines AT M15.....			1, 224	25. 700		612	612
85	Mines AP.....			98	. 370			98
86	Total.....				46. 389		-----	-----

See footnotes at end of table.

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapons ^{1,2}	Total basic load		How carried ³		
				Rounds	Tons	Individual	Vehicle ⁴	Trains ⁵
	RCN BN, ARMD DIV, TOE 17-45:							
87	Carbine, cal. .30.....	90	327	29,430	.486	45	30	15
88	Gun, machine, cal. .30 Flex.....	3,000	41	123,000	4.736	-----	1,500	1,500
89	Gun, machine, cal. .50 HB Flex.....	630	18	11,340	2.098	-----	525	105
90	Gun, submachine, cal. .45 ⁶	100	118	11,800	.325	40	60	-----
91	Launcher, grenade M7A2 ⁷	6	48	288	.990	-----	5	1
92	Launcher, rocket, 3.5 inch.....	14	37	518	2.429	-----	12	2
93	Mortar, 81 mm.....	120	12	1,440	6.984	-----	97	23
94	Pistol, auto, cal. .45.....	21	154	3,234	.089	21	-----	-----
95	Rifle, auto, cal. .30.....	1,000	12	12,000	.450	60	480	460
96	Rifle, U. S., cal. .30 M1.....	120	220	26,400	1.135	48	48	24
97	Mines AT M6.....	-----	-----	272	2.35	-----	96	176
98	Sniperscope (carbine).....	90	24	2,160	.04	45	30	15
99	Total.....	-----	-----	-----	19.961	-----	-----	-----
	ARMD INF BN, TOE 7-25:							
100	Carbine, cal. .30.....	90	264	23,760	.392	45	30	15
101	Gun, machine, cal. .30 HV.....	2,000	1	2,000	.077	-----	1,000	1,000
102	Gun, machine, cal. .30 Flex.....	3,000	83	249,000	9.587	-----	1,500	1,500
103	Gun, machine, cal. .50 HB Flex.....	625	10	5,250	.971	-----	315	210
104	Gun, submachine, cal. .45 ⁶	160	127	20,320	.559	40	60	60
105	Launcher, grenade, M7A2 ⁷	6	146	876	3.020	-----	5	1
106	Launcher, rocket, 3.5 inch.....	12	56	672	3.152	-----	6	6
107	Mortar, 81-mm.....	120	13	1,560	7.566	-----	97	23
108	Mortar, 4.2 inch.....	144	4	576	9.792	-----	74	70
109	Pistol, auto, cal. .45.....	21	94	1,974	.054	21	-----	-----
110	Rifle, auto, cal. .30.....	1,000	34	37,000	1.388	60	480	460
111	Rifle, U. S., cal. .30 M1.....	120	408	48,960	2.105	48	48	24
112	Rifle, U. S., cal. .30 MIC (Sniper's).....	96	36	3,456	.149	48	48	-----
113	Demolition set #5 ⁸	-----	5	-----	.04	-----	X	-----
114	Total.....	-----	-----	-----	38.816	-----	-----	-----
	TANK BN, (120-mm GUN) TOE 17-35:							
115	Carbine, cal. .30.....	85	260	22,100	.365	45	15	25
116	Gun, machine, cal. .30 Flex.....	3,250	16	52,000	2.002	-----	1,000	2,250
117	Gun, machine, cal. .50 HB Flex.....	625	14	7,350	1.359	-----	525	-----
118	Gun, submachine, cal. .45 ⁶	100	168	16,800	.462	-----	60	40
119	Launcher, grenade, M7A3 ⁷	10	4	40	.146	-----	5	5
120	Launcher, rocket, 3.5 inch.....	9	20	180	.844	-----	6	3
121	Mortar, 81-mm.....	120	1	120	.582	-----	97	23
122	Mortar, 4.2 inch.....	144	4	576	9.792	-----	74	10
123	Pistol, auto, cal. .45.....	21	365	7,665	.217	21	-----	-----
124	Rifle, auto, cal. .30.....	1,500	1	1,500	.056	60	480	960
125	Rifle, U. S., cal. .30.....	120	30	3,600	.155	48	48	20
126	Sniperscope (carbine).....	85	2	170	Negl	45	15	25
127	Demolition Set #5.....	-----	1	-----	Negl	-----	X	-----
128	Mines, AT M6A2.....	-----	-----	200	3.20	-----	-----	200
129	Total.....	-----	-----	-----	16.294	-----	-----	-----

See footnotes at end of table.

1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried *		
				Rounds	Tons	Indi- vidual	Vehicle ⁴	Trains ⁵
	TANK BN, (90-mm GUN) TOE 17-25							
130	Carbine, cal. .30.....	85	276	23,460	.387	45	15	25
131	Gun, machine, cal. .30 Flex.....	3,250	12	39,000	1.502		1,000	2,250
132	Gun, machine, cal. .50 HB Flex.....	525	15	7,875	1.457		315	210
133	Gun, submachine, cal. .45 ⁶	100	165	16,500	.454		60	40
134	Launcher, grenade, M7A2 ⁷	10	4	40	.140		5	5
135	Launcher, rocket, 3.5 inch.....	9	22	198	.929		6	3
136	Mortar 81-mm.....	120	1	120	.582		97	23
137	Mortar 4.2 inch.....	144	4	576	9.792		74	70
138	Pistol, auto, cal. .45.....	21	379	7,959	.219	21		
139	Rifle, auto, cal. .30.....	1,500	1	1,500	.056	60	480	960
140	Rifle, U. S., cal. .30 M1.....	104	30	3,120	.134	56		48
141	Sniper scope (carbine).....	85	2	170	Negl	45	15	25
142	Demolition Set #5.....		1		Negl		X	
143	Mines AT M6A2.....			200	3.20			200
144	Total.....				15.972			
	HQ & HQ BTRY, DIV ARTY, ARMED DIV, TOE 6-301A							
145	Carbine, cal. .30.....	90	74	6,660	.109	45	45	
146	Gun, machine, cal. .30 Flex.....	2,000	2	4,000	.154		1,000	1,000
147	Gun, machine, cal. .50 HB Flex.....	525	3	1,575	.291		525	
148	Gun, submachine, cal. .45 ⁶	100	31	3,100	.085	40	60	
149	Launcher, rocket, 3.5 inch.....	10	6	60	.281		10	
150	Pistol, auto, cal. .45.....	21	19	399	.011	21		
151	Rifle, U. S., cal. .30 M1.....	96	63	6,048	.260	48		48
152	Total.....				1.191			
	FA BN, (105-mm HOW) SP ARMD TOE 6-315							
153	Carbine, cal. .30.....	90	256	23,040	.380	45	45	
154	Gun, machine, cal. .30 Flex.....	2,000	10	20,000	.860		1,000	1,000
155	Gun, machine, cal. .50 HB Flex.....	525	14	7,350	1.350		525	
156	Gun, submachine, cal. .45 ⁶	100	63	6,300	.173	40	60	
157	Launcher, rocket, 3.5 inch.....	12	39	468	2.195		12	
158	Pistol, auto, cal. .45.....	21	10	210	.006	21		
159	Rifle, U. S., cal. .30 M1.....	96	289	27,744	1.193	48		48
160	Total.....				6.166			
	FA BN (155-mm HOW) SP ARMD TOE 6-325							
161	Carbine, cal. .30.....	90	203	18,270	.301	45	45	
162	Gun, machine, cal. .30 Flex.....	2,000	10	20,000	.770		1,000	1,000
163	Gun, machine, cal. .50 HB Flex.....	525	13	6,825	1.263		525	
164	Gun, submachine, cal. .45 ⁶	100	49	4,900	.135	40	60	
165	Launcher, rocket, 3.5 inch.....	10	35	350	1.642		10	
166	Pistol, auto, cal. .45.....	21	10	210	.006	21		
167	Rifle, U. S., cal. .30 M1.....	96	364	34,944	1.503	48		48
168	Total.....				5.620			

See footnotes at end of table.

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1	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapons ^{1 2}	Total basic load		How carried ³		
				Rounds	Tons	Individual	Vehicle ⁴	Trains ⁵
	AAA AW BN (SP) TOE 44-75							
169	Carbine, cal. .30.....	90	549	49,410	.815	45	45	-----
170	Gun, machine, cal. 50. HB Flex.....	525	13	6,825	1.263	-----	525	-----
171	Gun, submachine, cal. .45 ⁶	100	139	13,900	.382	40	60	-----
172	Launcher, rocket, 3.5 inch.....	12	52	624	2.927	-----	12	-----
173	Pistol, auto, cal. .45.....	21	3	63	Negl	21	-----	-----
174	Demolition Set #2.....	-----	4	-----	Negl	-----	X	-----
175	Total.....	-----	-----	-----	5.387	-----	-----	-----

¹ Weapons listed on standard nomenclature lists (SNL's) for vehicles as OVM equipment must be included in the computation of the total basic load of a unit. Necessary information is obtained from paragraph 107, or from appropriate SNL (or technical manual) if vehicle is not listed.

² Individual weapons computations are based on remarks column contained in the latest changes to section II of the appropriate table of organization and equipment for those units for which such changes have been issued.

³ This column indicates a suggested distribution only, and is not restrictive.

⁴ Includes trailer with towing vehicle when appropriate.

⁵ In those units which contain no supply vehicles for the hauling of class V supply, but do contain combat vehicles, only "vehicular stowage capacity," of paragraph 107 is included in the basic load of the unit, and the ammunition listed in "trains", paragraph 107, is *not* included.

⁶ Where vehicular stowage provides space for a greater number of rounds for gun, submachine, cal. .45, than indicated in this table, the full stowage capacity will be used in computing the basic load of the unit.

⁷ "Rounds per weapon," includes both the cartridge and the grenade.

⁸ Weight of "explosives" only in demolition sets.

⁹ Weight of all explosives in battalion shown under "explosives" includes the three types of demolition sets listed plus the supplementary set. The weight in column 4b includes 15 percent added for weight of containers. All other entries on this line are the weight of the explosive alone.

¹⁰ Additional transportation is required to transport this company. Organic transportation is inadequate.

¹¹ Ammunition for weapons in company headquarters is carried in "vehicle." For ammunition for weapons in replacement platoons, see note 10.

¹² 5 cart.

¹³ 5 gren.

¹⁴ 1 cart.; 1 gren.

¹⁵ Pounds.

¹⁶ Weight of explosives included under that heading

c. Weight of Armored Division Basic Load of Ammunition (based on type combat vehicles).¹

Unit	Wt of basic load for TOE wpns (tons)	Wt of basic load for SNL wpns (tons)	Total wt of unit basic load (tons)	Total wt for div (tons)
Hq, Armd Div, TOE 17-1.....	.404		.404	.404
Hq Co, Armd Div, TOE 17-2.....	3.407	4.584	7.991	7.091
Hq & Hq Co, Combat Command, TOE 17-22A.....	1.022	4.584	5.606	16.818
Armd Sig Co, TOE 11-57.....	2.064	.822	2.886	2.886
MP Co, Armd Div, TOE 19-27.....	1.150		1.150	1.150
Hq & Hq Co, Armd Div Trains TOE 17-62A.....	1.040		1.040	1.040
Band, Armd Div TOE 12-107.....	.064		.064	.064
Armd QM Bn, TOE 10-45.....	4.515		4.515	4.515
Armd Ord Bn, TOE, 9-65.....	5.234		5.234	5.234
Repl Co, Armd Div, TOE 20-7.....	1.184		1.184	1.184
Armd Eng TOE 5-215.....	46.389	9.240	55.629	55.629
Recon Bn, Armd Div, TOE 17-45.....	19.961	57.440	77.401	77.401
Armd Inf Bn, TOE 7-25.....	38.816	35.830	74.646	298.584
Tank Bn (120-mm Gun) TOE 17-35.....	16.294	218.021	234.315	234.315
Tank Bn (90-mm Gun) TOE 17-25A.....	15.972	221.012	236.984	710.952
Hq & Hq Btry, Div Arty, Armd Div TOE 6-301A.....	1.191	.822	2.013	2.013
FA Bn (105-mm How) SP Armd, TOE 6-315.....	6.166	131.660	137.826	413.478
FA Bn (155-mm How) SP Armd, TOE 6-325.....	5.620	222.788	228.408	228.408
AAA AW Bn (SP) TOE 44-75.....	5.387	121.669	127.048	127.048
Total armored division.....				2,189.114

d. Weight of Basic Load of Ammunition for Armored Units Other Than Armored Division Units (based on type vehicles).²

Unit	Wt of basic load for TOE wpns (tons)	Wt of basic load for SNL wpns (tons)	Total wt for unit basic load (tons)
Hq & Hq Co, Armd Cav Regt, TOE 17-52A.....	1.963	4.584	6.547
Svc Co, Armd Cav Regt, TOE 17-53A.....	7.164	2.745	9.909
3 Recon Bn, Armd Cav Regt, TOE 17-55.....	50.397	407.256	457.653
Total armored cav regt.....	59.524	414.585	474.109
Hq & Hq Armor Group, TOE 17-32A.....	.713		.713
Tank Bn (120-mm Gun) Non Div, TOE 17-35.....	15.791	212.866	228.657
Amph Tank Bn, TOE 17-115A.....	3.052	142.416	145.468
Amph Tractor Bn, TOE 17-125A.....	1.718	124.752	126.470
Ren Co, Inf Div, TOE 17-57.....	4.425	13.253	17.678
Tk Co (90-mm Gun) Inf Regt, TOE 17-37.....	.954	64.491	65.445
Tk Bn (90-mm Gun) Inf Div, TOE 17-25A.....	8.079	216.738	224.817

¹ See note in paragraph 111d.

² The following vehicles were used in computing these weights:

Tank 76-mm Gun M41.
 Tank 90-mm Gun M48.
 Tank 120-mm Gun T43E1.
 Vehicle Armored Inf M75.
 Vehicle Tank Recovery M32.
 Vehicle, Landing, tracked, LVT4.

Vehicle, Landing, tracked, armd, LVT5.
 Carrier, 81-mm mortar, half-track M21.
 Carriage, mtr multiple gun (cal. 50 AA) M16.
 Carriage mtr twin 40-mm Gun M19A1.
 Carriage mtr 105-mm How M37.
 Carriage 155-mm How M41.

112. Ammunition Supply Data—Infantry Division

a. Basic Load.

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	DIV HQ & HQ CO, TOE 7-2; MP CO, TOE 19-27; ORD Bn, TOE 9-25; SIG CO, TOE 11-7; BAND, TOE 12-107; QM CO, TOE 10-17; and REPL CO, TOE 20-7:							
2	Carbine, cal. .30.....	90	773	69,570	1.148	60	30	-----
3	Gun, machine, cal. .30, lt.....	2,000	13	26,000	1.001	-----	-----	-----
4	Gun, machine, cal. .50.....	530	33	17,490	-----	-----	530	-----
5	Gun, submachine, cal. .45.....	90	170	15,300	.421	30	60	-----
6	Launcher, rocket, 3.5-inch.....	4	34	136	.638	-----	4	-----
7	Pistol, cal. .45.....	21	172	3,612	.099	21	-----	-----
8	Rifle, auto., cal. .30.....	500	3	1,500	.056	180	320	-----
9	Rifle, cal. .30.....	96	500	48,000	2.064	48	48	-----
10	Rifle, 106-mm on mount.....	20	3	60	2.160	-----	20	-----
11	Explosives, etc.....	-----	-----	-----	.134	-----	-----	-----
12	Grenades, hand.....	-----	-----	950	1.219	-----	950	-----
13	Grenades, rifle.....	-----	-----	994	1.481	-----	994	-----
14	Total.....	-----	-----	-----	13.747	-----	-----	-----
	RCN CO, INFANTRY DIV TOE 17- 57: 13							
15	Carbine, cal. .30.....	90	62	5,580	.092	45	30	15
16	Gun, machine, cal. .30.....	2,000	9	18,000	.693	-----	1,000	1,000
17	Gun, machine, cal. .50 HB Flex.....	630	3	1,890	.349	-----	525	105
18	Gun, submachine, cal. .45 6.....	100	20	2,000	.055	-----	60	40
19	Launcher, rocket, 3.5-inch.....	14	6	84	.394	-----	12	2
20	Pistol, auto, cal. .45.....	21	35	735	.020	21	-----	-----
21	Rifle, auto, cal. .30.....	1,000	3	3,000	.113	60	480	460
22	Rifle, U. S., cal. .30 M1.....	120	54	6,480	.279	48	48	24
23	Sniperscope (carbine).....	90	6	540	Negl	45	30	15
24	Demolition Set #5 6.....	-----	3	-----	.030	-----	X	-----
25	Mines, AT M6A2.....	-----	-----	150	2.400	-----	-----	150
26	Total.....	-----	-----	-----	4.425	-----	-----	-----
	ENGINEER COMBAT BATTAL- ION, TOE 5-15:							
27	Carbine, cal. .30 M2.....	90	122	10,980	.181	60	-----	30
28	Gun, machine, cal. .30 BRG M1919A4.....	2,815	26	73,190	2.818	-----	2,065	750
29	Gun, submachine, cal. .45 M3A1.....	90	48	4,320	.119	60	-----	30
30	Gun, machine, cal. .50.....	730	28	20,440	3.781	-----	595	133
31	Launcher, rocket, 3.5-inch.....	12	40	480	2.251	-----	6	6
32	Pistol, auto, cal. .45 M1911 A1.....	28	7	196	.005	21	-----	7
33	Rifle, U. S., cal. .30 M1.....	96	658	63,168	2.716	48	-----	48
34	Explosives, 12, 140 lbs plus 15% for containers.....	-----	-----	-----	6.978	-----	-----	-----
35	Flare, trip.....	-----	-----	520	1.158	-----	420	100
36	Grenade, hand.....	-----	-----	1,153	1.400	-----	580	673

See footnotes at end of table.

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weap- ons	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	ENGINEER COMBAT BATTAL- ION, TOE 5-15—Continued							
37	Grenade, rifle			300	.420		200	100
38	Mine, AP			98	.481			98
39	Mine, AT			1,056	9.072		528	528
40	Total				31.380			
	THREE INFANTRY REGIMENTS (EACH), TOE 7-11 (LESS TANK CO):							
41	Carbine, cal. .30	90	743	66,870	1.103	60	15	15
42	Gun, machine, cal. .30	3,250	81	263,250	10.135		2,250	1,000
43	Gun, machine, cal. .50	600	59	35,400	6.549		400	200
44	Gun, submachine, cal. .45	560	5	2,800	.077	60	500	
45	Launcher, rocket, 3.5-inch	15	84	1,260	5.909		9	6
	Mortar:							
46	60-mm	72	27	1,944	4.374		36	36
47	81-mm	120	12	1,440	6.984		48	72
48	4.2-inch	144	12	1,728	29.376		74	70
49	Pistol, cal. .45	31	410	12,710	.349	21	7	3
50	Rifle, cal. .30:							
	Automatic	740	162	119,890	4.496	260	230	200
51	M1, M1C	200	1,957	391,400	16.830	72	96	32
52	Rifle, 57-mm	44	27	1,188	4.158		28	16
53	Rifle, 106-mm, on mount	40	18	720	25.920		24	16
54	Flares, trip			675	.970			
55	Grenades, hand			2,419	2.710			
56	Grenades, rifle			1,120	1.940			
57	Mines, AT, M7			1,000	3.690			
	Tank Co Inf Regt:							
58	Carbine, cal. .30	90	45	4,050	.067	60	30	
59	Gun, machine, cal. .50	550	1	550	.102		550	
60	Gun, submachine, cal. .45	300	32	9,600	.264		300	
61	Rocket, 3.5-inch	9	2	18	.084		6	3
62	Pistol, cal. .45	21	110	2,310	.065	21		
63	Mine, AT, M7A2			64	.230			
64	Mine, AP, M14 NM			180	.044			
65	Flare, trip			50	.072			
66	Grenade, hand			25	.026			
	Combat Vehicles:							
67	W/M47 Tanks				66.800			
68	W/M48 Tanks				52.900			
69	Total—one regt:							
70	W/M47 Tanks				193.234			
71	W/M48 Tanks				179.334			
	DIVISION ARTILLERY, TOE 6- 100A:							
72	Carbine, cal. .30	90	1,602	144,180	2.379	60		
73	Gun, antiaircraft, twin, 40-mm ea	720	32	23,040	76.032		560	160
74	Gun, machine, cal. .30, lt	2,000	42	84,000	3.234			
75	Gun, machine, cal. .50	530	98	51,940	9.609		530	

See footnotes at end of table.

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	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	DIVISION ARTILLERY, TOE 6-100A:—Continued							
76	Gun, AA, cal. .50 multiple mount, 4 guns.....	7,200	32	230,400	42.624	-----	5,880	1,320
77	Gun, submachine, cal. .45.....	90	457	41,130	1.131	60	30	-----
78	Howitzer, 105-mm.....	250	54	13,500	330.750	-----	150	100
79	Howitzer, 155-mm.....	150	18	2,700	155.250	-----	91	59
80	Launcher, rocket, 3.5-inch.....	6	210	1,260	5.909	-----	6	-----
81	Pistol, cal. .45.....	21	62	1,302	.036	21	-----	-----
82	Rifle, cal. .30, M1.....	72	1,207	86,904	3.737	48	24	-----
83	Total.....	-----	-----	-----	630.691	-----	-----	-----
	TK BN (90-mm GUN) INF DIV TOE 17-25A:							
84	Carbine, cal. .30.....	85	262	22,270	.367	45	15	25
85	Gun, machine, cal. .30 Flex.....	3,250	12	39,000	1.502	-----	1,000	2,250
86	Gun, machine, cal. .50 HB Flex.....	525	14	7,350	1.359	-----	525	-----
87	Gun, submachine, cal. .45 ⁴	100	156	15,600	.429	-----	60	40
88	Launcher, rocket, 3.5-inch.....	9	20	180	.844	-----	6	3
89	Pistol, auto, cal. .45.....	21	371	7,791	.214	21	-----	-----
90	Rifle, auto, cal. .30.....	1,500	1	1,500	.056	60	480	960
91	Rifle, U. S., cal. .30 M1.....	120	21	2,520	.108	48	48	24
92	Demolition Set #5.....	-----	1	-----	Negl	-----	X	-----
93	Mines, AT M6A2.....	-----	-----	200	3.200	-----	-----	200
94	Total.....	-----	-----	-----	8.079	-----	-----	-----

For explanation of notes, see paragraph 111.

For total weight of basic load, see paragraph 111.

b. Other Units.

- (1) One-quarter ton trailers in rifle company are 90 percent overloaded.
- (2) One-quarter ton trailers in 81-mm mortar squads are 85 percent overloaded (inf regt).
- (3) One-quarter ton trailers in cal. .30 machine gun squads are 18 percent overloaded (inf regt).
- (4) Three each 2½-ton trucks in battalion ammunition section are 40 percent overloaded (inf regt).
- (5) Two and one-half ton trucks with 1½-ton trailers in tank bns are 30 percent overloaded (tank bn).
- (6) Seventh section each 105-mm how. Btry are 20 percent overloaded (div arty).
- (7) Seventh section each 155-mm how. Bn Tns are 45 percent overloaded (div arty).

c. Resupply Capacity of Organic Ammunition Vehicles—Infantry Division.

	1	2	3	4	5	6
1	Unit	Truck, 4-ton	Truck, 2½-ton	Trailer cargo 1½-ton	Trailer ammo 2-ton	Capacity (tons)
2	One infantry regiment.....		18	18		72
3	Three infantry regiments.....		54	54		216
4	One 105-mm how bn.....		21		21	94.5
5	Three 105-mm how bn.....		63		63	283.5
6	One 155-mm how bn.....	9	15		24	121.5
7	AAA AW bn SP.....		12	12		48
8	Total Div Arty.....	9	90	12	87	453
9	Tank bn, 90-mm gun.....		14	14		56
10	Total for division.....	9	158	80	87	725

113. Ammunition Supply Data—Armored Cavalry Units

	1	2	3 ¹	4		5 ²		
1	Weapon (unit)	Rounds per weapon	No. of weapons ³	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Ve- hicle ⁴	Trains
	HQ & HQ CO, ARMD CAV REGT TOE 17-52A:							
2	Carbine, cal. .30.....	90	65	5,850	.097	45	30	15
3	Gun, machine, cal. .30 Flex.....	2,000	4	8,000	.308		1,000	1,000
4	Gun, machine, cal. .50 HB Flex.....	525	3	1,575	.291		420	105
5	Gun, submachine, cal. .45 ⁵	160	45	7,200	.198	40	60	60
6	Launcher, rocket, 3.5 incb.....	12	12	132	.619		6	6
7	Pistol, auto, cal. .45.....	21	23	493	.013	21		
8	Rifle, auto, cal. .30.....	1,500	3	4,500	.169	60	480	960
9	Rifle, U. S., cal. .30.....	120	52	6,240	.268	48	48	24
10	Total.....				1.963			
	SVC CO, ARMD CAV REGT, TOE 17-53A:							
11	Carbine, cal. .30.....	90	80	7,200	.119	45	30	15
12	Gun, machine, cal. .30 Flex.....	4,000	17	68,000	2.618		2,000	2,000
13	Gun, machine, cal. .50 HB Flex.....	840	17	14,280	2.642		672	168
14	Gun, submachine, cal. .45 ⁵	160	97	15,520	.427	45	60	55
15	Launchee, rocket, 3.5 incb.....	12	20	240	1.126		6	6
16	Pistol, auto, cal. .45.....	21	1	21	Negl	21		
17	Rifle, U. S. cal. .30 M1.....	120	45	5,400	.232	48	48	24
18	Total.....				7.164			
	ARMD CAV RCN BN ACR TOE 17-55:							
19	Carbine, cal. .30.....	90	219	19,710	.325	45	30	15
20	Gun, machine, cal. .30 Flex.....	4,000	31	124,000	4.774		1,500	2,500
21	Gun, machine, cal. .50 HB Flex.....	840	14	11,760	2.176		525	315

See footnotes at end of table.

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	1	2	3 ¹	4		5 ²		
1	Weapon (unit)	Rounds per weapon	No. of weapons ²	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Ve- hicle ⁴	Trains
	ARMED CAV RCN BN ACR TOE 17-55—Continued							
22	Gun, submachine, cal. .45 ⁶	160	114	18,240	.502	40	60	60
23	Launcher, grenade, M7A2 ⁷	6	36	216	.740	-----	5	1
24	Launcher, rocket, 3.5 inch.....	12	26	312	1.463	-----	6	6
25	Mortar 81 mm.....	120	9	1,080	5.238	-----	97	23
26	Pistol, auto, cal. .45.....	21	204	4,284	.118	21	-----	-----
27	Rifle, auto, cal. .30.....	1,000	9	9,000	.338	60	480	460
28	Rifle, U. S., cal. .30.....	120	216	25,920	1.115	48	48	24
29	Sniperscope (carbine).....	90	9	810	.010	45	30	15
30	Demolition Set # 5.....	-----	3	-----	Negl	-----	X	-----
31	Total.....	-----	-----	-----	16,799	-----	-----	-----
	HQ & HQ CO, ARMOR GROUP TOE 17-32A:							
32	Carbine, cal. .30.....	90	30	2,700	.045	45	30	15
33	Gun, machine, cal. .50 HB Flex.....	525	5	2,625	.486	-----	420	105
34	Gun, submachine, cal. .45 ⁶	160	14	2,240	.062	40	60	60
35	Launcher, grenade M7A3 ⁷	6	6	36	.120	-----	5	1
36	Total.....	-----	-----	-----	.713	-----	-----	-----
	TK BN (120-mm GUN) NON DIV TOE 17-35:							
37	Carbine, cal. .30.....	85	262	22,270	.367	45	15	25
38	Gun, machine, cal. .30 Flex.....	3,250	12	39,000	1.502	-----	1,000	2,250
39	Gun, machine, cal. .50 HB Flex.....	525	14	7,350	1.359	-----	525	-----
40	Gun, submachine, cal. .45 ⁶	100	168	16,800	.462	-----	60	40
41	Launcher, grenade M7A3 ⁷	10	4	40	.140	-----	5	5
42	Launcher, rocket, 3.5 inch.....	9	20	180	.844	-----	6	3
43	Mortar 81-mm.....	120	1	120	.582	-----	97	23
44	Pistol, auto, cal. .45.....	21	365	7,665	.212	21	-----	-----
45	Rifle, auto, cal. .30.....	1,500	1	1,500	.056	60	480	960
46	Rifle, U. S., cal. .30 M1.....	120	30	3,600	.155	48	48	20
47	Mortar 4.2 inch.....	144	4	576	9.792	-----	74	10
48	Demolition Set #5.....	-----	1	-----	Negl	-----	X	-----
49	Mines AT M6A2.....	-----	-----	200	3.200	-----	-----	200
50	Total.....	-----	-----	-----	15.791	-----	-----	-----
	AMPHIBIOUS TK BN, TOE 17- 115A:							
51	Carbine, cal. .30.....	90	314	28,260	.466	45	45	-----
52	Gun, machine, cal. .50 HB Flex.....	525	8	4,200	.777	-----	525	-----
53	Gun, submachine, cal. .45 ⁶	100	172	17,200	.473	40	60	-----
54	Launcher, rocket, 3.5 inch.....	12	19	228	1.069	-----	12	-----
55	Pistol, auto, cal. .45.....	21	436	9,156	.252	21	-----	-----
56	Rifle, U. S., cal. .30 M1.....	120	3	360	.015	48	68	-----
57	Total.....	-----	-----	-----	3.052	-----	-----	-----

See footnotes at end of table.

1	1	2	3 ¹	4		5 ²		
	Weapon (unit)	Rounds per weapon	No. of weapon- s ³	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehi- cle ⁴	Trains
	AMPHIBIOUS TRACTOR BN TOE 17-125A:							
58	Carbine, cal. .30.....	90	295	26,550	.438	45	45	-----
59	Gun, machine, cal. .50 IIB Flex.....	525	4	2,100	.389	-----	525	-----
60	Gun, submachine, cal. .45 ⁶	100	25	2,500	.069	40	60	-----
61	Launcher, rocket, 3.5 inch.....	12	11	132	.610	-----	12	-----
62	Pistol, auto, cal. .45.....	21	334	7,014	.193	21	-----	-----
63	Rifle, U. S., cal. .30 M1.....	120	2	240	.010	48	68	-----
64	Total.....	-----	-----	-----	1.718	-----	-----	-----

For explanation of notes, see paragraph 111.

For total weight of basic load, see paragraph 111d.

114. Ammunition Supply Data—Artillery Units

a. Basic Load.

(1) Field Artillery

	1	2	3	4		5		
	Weapon (unit)	Rounds per weapon	No. of weapon- s	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
1	HQ & HQ BTRY, FA GP, TOE 6-401:							
2	Carbine, cal. .30.....	90	114	10,260	.17	45	45	-----
3	Gun, machine, cal. .30.....	530	6	3,180	.59	-----	530	-----
4	Launcher, rocket, 3.5-inch.....	6	6	36	.17	6	-----	-----
5	Pistol, automatic, cal. .45.....	21	11	231	.01	21	-----	-----
6	Total.....	-----	-----	-----	.94	-----	-----	-----
	HQ & HQ BTRY, CORPS ARTY, TOE 6-501A:							
7	Carbine, cal. .30.....	90	75	6,750	.11	45	45	-----
8	Gun, machine, cal. .50.....	530	2	1,060	.20	-----	530	-----
9	Launcher, rocket, 3.5-inch.....	6	6	36	.17	8	-----	-----
10	Pistol, automatic, cal. .45.....	21	37	777	.02	21	-----	-----
11	Total.....	-----	-----	-----	.50	-----	-----	-----
	FA BN, 75-mm HOW PK, TOE 6-115A:							
12	Carbine, cal. .30.....	90	531	47,790	.79	45	45	-----
13	Rifle, automatic, cal. .30.....	740	15	11,100	.41	100	640	-----
14	Pistol, automatic, cal. .45.....	21	3	63	.01	21	-----	-----
15	Gun, submachine, cal. .45.....	90	3	270	.01	45	45	-----
16	Gun, machine, cal. .50.....	530	9	4,770	.88	-----	530	-----
17	Howitzer, pack, 75-mm.....	63	12	756	8.32	-----	36	27
18	Total.....	-----	-----	-----	10.42	-----	-----	-----

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	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapon- ons	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	FA BN, 105-mm HOW, TOWED, TOE 6-125A:							
19	Carbine, cal. .30.....	90	509	45,810	.76	45	45	
20	Gun, machine, cal. .50.....	530	23	12,190	2.24		530	
21	Gun, submachine, cal. .45.....	90	3	270	.01	45	45	
22	Howitzer, 105-mm.....	250	18	4,500	110.25		60	190
23	Launcher, rocket, 3.5-inch.....	6	46	276	1.30	6		
24	Pistol, automatic, cal. .45.....	21	110	2,310	.06	21		
25	Total.....				114.62			
	FA BN, 105-mm HOW, SP, ARMD, TOE 6-315:							
26	Carbine, cal. .30.....	90	435	39,150	.65	45	45	
27	Gun, machine, cal. .50.....	530	21	11,130	2.05		530	
28	Gun, submachine, cal. .45.....	90	3	270	.01	45	45	
29	Howitzer, 105-mm, mtr carriage.....	250	18	4,500	110.25		56	194
30	Launcher, rocket, 3.5-inch.....	6	40	240	1.13	8		
31	Pistol, automatic, cal. .45.....	21	68	1,428	.04	21		
32	Total.....				114.13			
	FA BN, 155-mm HOW, SP, ARMD, TOE 6-325:							
33	Carbine, cal. .30.....	90	535	48,150	.79	45	45	
34	Gun, machine, cal. .50.....	530	23	12,190	2.25		530	
35	Gun, submachine, cal. .45.....	90	3	270	.01	45	45	
36	Howitzer, 155-mm ,motor carriage.....	150	18	2,700	155.25		24	126
37	Launcher, rocket, 3.5-inch.....	6	46	276	1.30	6		
38	Pistol, automatic, cal. .45.....	21	106	2,226	.06	21		
39	Total.....				159.66			
	FA BN, 155-mm GUN, TOWED, TOE 6-415A:							
40	Carbine, cal. .30.....	90	486	43,740	.72	45	45	
41	Gun, machine, cal. .50.....	530	19	10,070	1.86		530	
42	Gun, submachine, cal. .45.....	90	3	270	.01	45	45	
43	Gun, 155-mm.....	120	12	1,440	138.24		30	90
44	Launcher, rocket, 3.5-inch.....	6	34	204	.96	8		
45	Pistol, automatic, cal. .45.....	21	63	1,323	.04	21		
46	Total.....				141.83			
	FA BN, 8-IN HOW, TOWED, TOE 6-415A:							
47	Carbine, cal. .30.....	90	513	46,170	.76	45	45	
48	Gun machine, cal. .50.....	530	19	10,070	1.86		530	
49	Howitzer, 8-inch.....	100	12	1,200	141.60		20	80
50	Launcher, rocket, 3.5-inch.....	6	34	204	.96	8		
51	Pistol, automatic, cal. .45.....	21	63	1,323	.04	21		
52	Total.....				145.22			

1	2	3	4		5		
			Total basic load		How carried		
			Rounds	Tons	Individual	Vehicle	Trains
	Weapon (unit)	Rounds per weapon	No. of weapons				
	FA OBSERVATION BN, TOE 6-575:						
53	Carbine, cal. .30.....	90	801	72,090	1.19	45	45
54	Gun, machine, cal. .50.....	530	26	13,780	2.54		530
55	Gun, submachine, cal. .45.....	90	12	1,080	.03	45	45
56	Launcher, rocket, 3.5-inch.....	6	34	204	.96	6	
57	Pistol, automatic, cal. .45.....	21	8	168	.01	21	
58	Total.....			4.73			
	FA BN, 4.5-INCH ROCKET, TOWED, TOE 6-615:						
59	Carbine, cal. .30.....	90	536	48,240	.79	45	45
60	Gun, machine, cal. .50.....	530	23	12,190	2.24		530
61	Launcher, rocket, 3.5-inch.....	6	28	168	.79	6	
62	Launcher, rocket, multiple 4.5-inch (24 tube).....	72	36	2,592	52.49		24
63	Pistol, automatic, cal. .45.....	21	7	147	.01	21	
64	Total.....			56.32			
	FA BN 8-INCH HOW, SP, TOE 6-435A:						
65	Carbine, cal. .30.....	90	438	43,920	.72	45	45
66	Gun, machine, cal. .50.....	530	19	10,070	1.86		530
67	Gun, submachine, cal. .45.....	90	3	270	.01	45	45
68	Howitzer, 8-inch, motor carriage.....	148	12	1,776	209.57		12
69	Launcher, rocket, 3.5-inch.....	6	34	204	.96		
70	Pistol, automatic, cal. .45.....	21	64	1,344	.04	21	
71	Total.....			213.16			
	FA BN, 240-mm HOW, OR 8-IN GUN, TOWED, TOE 6-515A:						
72	Carbine, cal. .30.....	90	432	38,880	.64	45	45
73	Gun, machine, cal. .50.....	530	19	10,070	1.86		530
74	Howitzer, 240-mm.....	100	6	600	139.50		28
	or						
75	Gun, 8-inch.....	100	6	600	115.80		28
76	Launcher, rocket, 3.5-inch.....	6	28	168	.79	8	
77	Pistol, automatic, cal. .45.....	21	63	1,323	.04	21	
78	Total, 240-mm how Bn.....			142.83			
79	Total, 8-inch gun Bn.....			119.13			
	FA BN, 155-mm GUN, SP, TOE 6-435A:						
80	Carbine, cal. .30.....	90	461	41,490	.68	45	45
81	Gun, machine, cal. .50.....	530	19	10,070	1.86		530
82	Gun, submachine, cal. .45.....	90	3	270	.01	45	45
83	Gun, 155-mm motor carriage.....	173	12	2,076	199.29		20
84	Launcher, rocket, 3.5-inch.....	6	34	204	.96	8	
85	Pistol, automatic, cal. .45.....	21	64	1,344	.04	21	
86	Total.....			202.84			

(2) *Antiaircraft artillery.*

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weap- ons	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	HQ & HQ BTRY, AAA BRIG, TOE 44-101A:							
2	Carbine, cal. .30.....	90	80	7,200	.119	45	45	
3	Pistol, cal. .45.....	21	8	168	.005	21		
4	Gun, submachine, cal. .45.....	90	17	1,530	.042	45	45	
5	Gun, machine, cal. .50.....	530	6	3,180	.584		3,180	
6	Launcher, grenade.....	10	6	60	.090		60	
7	Launcher, rocket, 3.5-inch.....	6	4	24	.113		24	
8	Grenades, fragmentation.....			50	.053		50	
9	Total.....				1.006			
	HQ & HQ BTRY, AAA GP, TOE 44-12A:							
10	Carbine, cal. .30.....	90	78	7,020	.116	45	45	
11	Pistol, cal. .45.....	21	7	147	.004	21		
12	Gun, submachine, cal. .45.....	90	19	1,710	.047	45	45	
13	Gun, machine, cal. .50.....	530	6	3,180	.584		3,180	
14	Launcher, grenade.....	10	6	60	.090		60	
15	Launcher, rocket, 3.5-inch.....	6	4	24	.113		24	
16	Grenade, fragmentation.....			50	.053		50	
17	Total.....				1.007			
	AAA OPR DET, TOE 44-7A:							
18	Carbine, cal. .30.....	90	46	4,140	.068	45	45	
19	Pistol, cal. .45.....	21	1	21		21		
20	Gun, submachine, cal. .45.....	90	9	810	.022	45	45	
21	Gun, machine, cal. .50.....	530	3	1,590	.292		1,590	
22	Launcher, grenade.....	10	2	20	.030		20	
23	Launcher, rocket, 3.5-inch.....	6	2	12	.056		12	
24	Grenade, fragmentation.....			25	.027		25	
25	Total.....				.495			
	AAA GUN BN (90-mm) TOE 44-15A:							
26	Carbine, cal. .30.....	90	647	58,230	.961	45	45	10,410
27	Pistol, cal. .45.....	21	3	63		21		
28	Gun, submachine, cal. .45.....	90	135	12,150	.334	45	45	4,050
29	Gun, machine, cal. .50 (flexible).....	530	46	24,380	4.510		24,380	
30	Mount, multiple (4), MG, cal. .50, M-55.....	4,240	16	67,840	12.467		55,120	12,720
31	Gun, 90-mm.....	175	16	2,800	95.200		2,480	320
32	Launcher, grenade.....	10	50	500	.750		500	
33	Launcher, rocket, 3.5-inch.....	12	22	264	1.238		264	
34	Grenade, fragmentation.....			400	.424		400	
35	Total.....				115.884			

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weap- ons	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	AAA GUN BN (120-mm) *TOE 44-115A:							
36	Carbine, cal. .30.....	90	634	57,060	.941	45	45	
37	Pistol, cal. .45.....	21	3	63		21		
38	Gun, submachine, cal. .45.....	90	69	6,210	.171	45	45	
39	Gun, machine, cal. .50.....	530	25	13,250	2.451		13,250	
40	Mount, multiple (4) MG, cal. .50, M-55.....	4,240	16	67,840	12.467		67,840	
41	Gun, 120-mm.....	90	16	1,440	104.400		640	800
42	Launcher, grenade.....	10	50	500	.750		500	
43	Launcher, rocket, 3.5-inch.....	6	22	132	.619		132	
44	Grenade, fragmentation.....			200	.212		200	
45	Total.....				122.011			
	AAA AUTO WPNS BN, MBL, TOE 44-25A:							
46	Carbine, cal. .30.....	90	784	70,560	1.164	45	45	23,520
47	Pistol, cal. .45.....	21	3	63		21		
48	Gun, submachine, cal. .45.....	90	155	13,950	.384	45	45	4,650
49	Gun, MG, cal. .50 (flexible).....	530	30	15,900	2.942		15,900	
50	Mount, multiple (4) MG, cal. .50, M-55.....	6,000	32	192,000	35.520		153,700	38,425
51	Gun, 40-mm.....	300	32	9,600	31.680		7,680	1,920
52	Launcher, grenade.....	10	44	440	.660		440	
53	Launcher, rocket, 3.5-inch.....	6	52	312	1.463		312	
54	Grenade, fragmentation.....			400	.424		400	
55	Total.....				74.237			
	AAA AUTO WPNS BN, SP, TOE 44-75:							
56	Carbine, cal. .30.....	90	630	56,700	.936	45	45	18,900
57	Pistol, cal. .45.....	21	3	63		21		
58	Gun, submachine, cal. .45.....	90	139	12,510	.344	45	45	4,170
59	Gun, machine, cal. .30.....	3,000	18	54,060	2.079		36,000	18,000
60	Gun, machine, cal. .50 (flexible).....	530	27	14,310	2.630		14,310	
61	Carriage, motor, multiple (4) MG, cal. .50, M-16.....	7,200	32	230,550	42.369		188,150	42,400
62	Carriage, motor, twin 40-mm gun, M-19.....	720	32	23,040	76.032		17,920	5,120
63	Launcher, grenade.....	10	81	810	1.215		810	
64	Grenades, fragmentation.....			1,000	1.060		1,000	
65	Mortar, 81-mm.....	30	1	30	.146		30	
66	Total.....				126.811			

* AAA Gun Bn (120-mm), TOE 44-115, is semimobile with sufficient organic transportation to move a single battery as a unit. Therefore, ammunition for only 1 battery can be transported at one time with the organic transportation.

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapons	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	ABN AA BN, TOE 44-275A:							
67	Carbine, cal. .30.....	90	478	43,020	.709	45	45	-----
68	Pistol, cal. .45.....	21	549	11,529	.317	21	-----	-----
69	Gun, submachine, cal. .45.....	90	68	6,120	.168	45	45	-----
70	Gun, machine, cal. .50 (flexible).....	530	52	27,560	5.065	-----	530	-----
71	Mount, tlr, multiple MG (4), M-55.....	5,300	24	127,200	23.376	-----	76,320	50,880
72	Gun, 40-mm.....	264	24	6,336	20.988	-----	3,456	2,880
73	Launcher, grenade.....	10	55	550	.825	-----	550	-----
74	Launcher, rocket, 3.5-inch.....	12	56	672	3.152	-----	672	-----
75	Grenade, fragmentation.....	-----	-----	1,000	1.060	-----	1,000	-----
76	Total.....	-----	-----	-----	55.660	-----	-----	-----
	AAA Battalion 75-mm Gun, Mobile TOE 44-35R 10 Feb 1955:							
77	Carbine, Cal. .30.....	90	148	13,320	.22	45	45	-----
78	Pistol, Cal. .45.....	21	3	63	-----	21	-----	-----
79	Gun Machine Cal. .50 M2.....	530	32	16,960	3.14	-----	16,960	-----
80	Gun 75-mm on Mount.....	200	18	3,600	60.30	-----	2,340	1,260
81	Launcher, Rocket 3.5-inch.....	6	23	138	.65	-----	138	-----
82	Rifle U. S. Cal. .30.....	120	284	34,080	1.47	48	72	-----
	Total.....	-----	-----	-----	65.78	-----	-----	-----

b. Resupply Capacity, Organic Ammunition Vehicles (prime movers of weapons and weapon carriers not included).

	1	2	3	4	5	6	7	8	9	10
1	Unit	Pack mule (10-ton each)	Truck, 2½-ton, and trailer, 1½-ton	Truck, 2½-ton, and trailer, M10A1 ¹	Truck, 4-ton, and trailer, M10A1 ¹	Tractor, M5 ² , and trailer, M10A1 ¹	Truck, 5-ton	Truck, 7½-ton	Truck, 7½-ton, and trailer, M10A1 ¹	Capacity (tons)
2	FA bn, 75-mm howitzer, pack.....	84	3	0	-----	-----	-----	-----	-----	43.62
3	FA bn, 105-mm howitzer, towed.....	-----	-----	21	-----	-----	-----	-----	-----	81.27
4	FA bn, 105-mm howitzer, SP, armored.....	-----	-----	21	-----	-----	-----	-----	-----	81.27
5	FA bn, 4.5-lb rocket, towed.....	-----	9	-----	-----	-----	-----	-----	-----	36.00
6	FA bn, 155-mm howitzer, towed.....	-----	-----	12	9	3	-----	-----	-----	103.00
7	FA bn, 155-mm howitzer, SP, armored.....	-----	-----	12	18	-----	-----	-----	-----	143.10
8	FA bn, 155-mm gun, towed.....	-----	-----	-----	-----	-----	0	12	-----	120.00
9	FA bn, 155-mm gun, SP.....	-----	-----	-----	-----	-----	0	-----	12	136.44
10	FA bn, 8-in howitzer, towed.....	-----	-----	-----	-----	-----	0	12	-----	120.00
11	FA bn, 8-in howitzer, SP.....	-----	-----	-----	-----	-----	6	-----	12	136.44
12	FA bn, 8-in gun or 240-mm howitzer.....	-----	-----	-----	-----	-----	6	-----	-----	30.00
13	FA bn, 280-mm gun.....	-----	(³)	-----	-----	-----	10	-----	-----	120.00

¹ Trailer, M10A1, carries 1.37 tons ammunition (56 rounds 105-mm, 23 rounds 155-mm).

² Tractor, M5, carries 24 rounds 155-mm ammunition (1.38 tons), 58 rounds 105-mm (1.38 tons).

³ 4 trucks, 20 trailers.

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115. Ammunition Supply Data—Chemical Units

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapon- ons	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	HQ & HQ DET OML SMK GENR BN, TOE 3-266A, 9 Apr 53:							
2	Carbine, cal. 30.....	90	13	1,170	.020	60		30
3	Pistol, auto, cal. 45.....	21	2	42		21		
4	Rifle, U. S., cal. 30.....	96	6	576	.026	48	48	
5	Gun, Submachine, cal. 45 M3A1.....	90	1	90		90		
6	Total.....				.046			
	CML SMK GENR CO: TOE 3-267A, 9 Apr 53:							
7	Carbine, cal. 30.....	90	96	8,640	.143	60		30
8	Gun, machine, cal. 50.....	530	2	1,060	.196		530	
9	Gun, machine, cal. 30.....	2,000	4	8,000	.308		2,000	
10	Launcher, grenade M7A2.....	10	13	130	.100		10	
11	Launcher, rocket, 315 in M20.....	6	4	24	.113		6	
12	Rifle, auto, cal. 30, Browning.....	500	5	2,500	.094	180	320	
13	Rifle, U. S., cal. 30.....	96	23	2,208	.095	48	48	
14	Gun, submachine, cal. 45, M3A1.....	90	15	1,350	.038	60	30	
15	Generator, smoke, mech, M3 ¹	² 4	48	² 240	52.72		³ 48	⁴ 192
		³ 4		³ 144	3.024		³ 48	³ 96
		⁴ 4		⁴ 192	4.800		⁴ 100	⁴ 92
10	Total.....				53.677			

¹ A single mech smk genr operating at maximum capacity consumes approximately 1,200 gallons of fog oil per 24-hour day.

² 55 gallon drum (fog oil).

³ 5 gallon gas cans (80 octane gas).

⁴ 5 gallon cans (water).

116. Ammunition Supply Data—Engineers

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weapons	Total basic load		How carried		
				Rounds	Tons	Individual	Vehicle	Trains
	ENGR COMBAT BN, ARMY TOE 5-35A							
2	Carbine, cal. .30 M2.....	60	102	6,120	.101	60		50
3	Flare, trip, M49.....			275	.325		225	50
4	Flare, trip, parachute, M48.....			140	.616		90	50
5	Grenade, fragmentation.....			525	.557		225	300
6	Grenade, fragmentation, offensive.....			378	.500		162	216
7	Grenade, hand, incendiary.....			16	.025			16
8	Grenade, hand, smoke, WP, M15.....			64	.100		48	16
9	Gun, machine, cal. .30, Browning M1919A4, flexible.....	1,000	20	20,000	.770		1,000	
10	Gun, machine, cal. .50, HB, flexible.....	530	18	9,540	1.765		530	
11	Gun, submachine, cal. .45, M3A1.....	90	37	3,330	.092	60	30	
12	Launcher, rocket, 3.5-inch, M20.....	12	31	372	1.745		31	
13	Mine, AP, M2A3.....			50	.192			50
14	Mine, AP, M3.....			48	.293			48
15	Mine, AT, HE, HV M6.....			420	6.300		180	240
16	Mine, AT, HE, L M7A1.....			504	1.638		216	288
17	Pistol, automatic, cal. .45.....	21	5	105	.002	21		
18	Rifle, US, cal. .30, M1.....	96	495	47,520	2.043	48	4,472	33,360
19	Total.....				17.064			

117. Ammunition Supply Data—Signal Corps

	1	2	3	4		5		
1	Weapon (unit)	Rounds per weapon	No. of weap- ons	Total basic load		How carried		
				Rounds	Tons	Indi- vidual	Vehicle	Trains
	SIGNAL BN CORPS TOE 11-15:							
2	Carbine, cal .30.....	60	769	46,140	.761	60		
3	Gun, machine, cal .50.....	530	30	15,900	2.942		530	
4	Gun, submachine, cal .45.....	90	144	12,960	.356	60	30	
5	Launcher, rocket, 3.5 inch.....	4	32	128	.600		4	
6	Pistol, cal .45.....	21	24	504	.012	21		
7	Rifle, cal .30, M1.....	96	261	25,056	1.077	48	48	
8	Total.....				5.748			

118. Ammunition Supply Data—Service Units

For planning purposes, assume service units not likely to become involved in direct combat with the enemy, to carry a basic load of ammunition as follows:

	1	2
1	Weapon	Rounds per weapon
2	Carbine, cal. .30.....	60
3	Rifle, cal. .30.....	96
4	Weapons to be used against hostile aircraft *.....	530

*Machine guns, cal. .50 and cal. .30.

Section VI. MISCELLANEOUS SUPPLY

119. Water Supply

a. Water Requirements.

	1	2	3	4
1	Unit consumer	Conditions of use	Gallons per unit consumer per day*	Remarks
2	Man.....	In combat: Minimum.....	1/4-1.....	For periods not exceeding 3 days when operational rations are used.
		Normal.....	2.....	When field rations are used.
		March or bivouac.....	3.....	Drinking plus small amount for cooking or personal hygiene.
		Temporary camp.....	2.....	Minimum for all purposes.
		Temporary camp with bathing facilities.	5.....	Desirable for all purposes (does not include bathing).
		Semipermanent camp.	15.....	Includes allowance for water-borne sewage system.
		Permanent camp.....	30-60.....	
3	Horse or mule.....	Minimum.....	60-100.....	Drinks from 3-5 gallons at a watering and requires 5 minutes to drink.
4	Vehicle.....	Level and rolling country..	3-5.....	Depending on size of vehicle.
		Mountainous country.....	1/4-1.....	Depending on size of vehicle.
5	Locomotive.....	Standard military.....	Variable.....	150 gallons per train mile.
		Commercial.....	Variable.....	200 gallons per train mile.
6	Hospital.....	Drinking and cooking.....	10 per bed.....	Minimum, does not include bathing or water for flushing.
		With water-borne sewage.	50 per bed.....	Includes water for medical personnel.
7	Smoke generator, M2.	Semimobile.....	150 gallons per day unversally.	
8	Impregnating plant, clothing M2.	Maximum impregnating capacity.	3,000.....	Suspension process.

*In hot climates, maximum requirements may exceed values given by 15 to 100 percent.

b. Water Equipment Issued to Engineer Units.

Unit	Number of sets (each set can equip one water point)	Equipment in each set					Total Discharge (gpm)		Total Storage capacity gallons ²	Maximum daily production gallons ³	Water transport equipment
		Filter	Pumps		Tanks		Pump- ing ¹	Filter- ing			
			No.	Dis- charge (gpm)	No.	Capac- ity (gal)					
Engr bn c.....	4	35 gpm portable diatomite.....	4	55	3	3,000	800	140	12,000	168,000	18 700-gal tankers. 6 1,500-gal semitrailers.
Armd engr bn.....	2	35 gpm portable diatomite.....	4	55	3	3,000	800	140	6,000	34,000	
	4	15 gpm pack diatomite.....	2	30	4	500	45	15	2,000	56,000	
Abn engr bn.....	4	35 gpm portable diatomite.....	4	55	3	3,000	800	140	12,000	168,000	
Engr boat and shoro rogt.....	2	35 gpm portablo diatomite.....	4	55	3	3,000	400	70	6,000	84,000	
Engr cons bn.....	2	35 gpm portable diatomite.....	4	55	3	3,000	400	70	6,000	84,000	
Engr topo bn, army.....	1	15 gpm pack diatomite.....	2	30	4	500	45	15	500	18,000	
Engr topo co, corps.....	1	15 gpm pack diatomite.....	2	30	4	500	45	15	500	18,000	
Engr survey bn.....	1	15 gpm pack diatomite.....	2	30	4	500	45	15	500	18,000	
Engr w sup com.....	9	50 gpm portable diatomite.....	5	55	4	3,000	2,295	450	27,000	540,000	
Engr w sup team CA.....	1	15 gpm pack diatomite.....	2	30	4	500	45	15	500	18,000	
Engr w sup team CB.....	1	50 gpm portable diatomite.....	5	55	4	3,000	255	50	3,000	60,000	
Engr w sup team CC.....	1	One distillation unit.....								2,500	
Engr w sup team CD.....	1	One well rig.....									
Engr w sup team CE.....											
Engr w sup team CF.....											

¹ One pump at purification rate, others at full rated capacity.

² Within each set only one tank is available for storage. The remaining tanks are used in the treatment process.

³ Since a part of the equipment is normally held in reserve, the maximum daily production is not normally attained.

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c. Distillation Units.

1	1	2	3	4	5	6	7	8	9	10	11	12
	Type	Distillate capacity		Economy pounds distilled per lb fuel	Fuel required		Raw water required gph	Mounting	Weight lb	Dimensions		
		Gph	Gpd*		Type	Gph				Length	Width	Height
2	Thermo-compression.....	60	1,200	100	Gasoline....	1	130	Skid.....	4,300	7 ft 8 in.....	4 ft 6 in.....	5 ft.
								Trailer.....	4,700	12 ft 7 in.....	7 ft 0 in.....	6 ft 2 in.
3	Thermo-compression (Badger).....	150	3,000	150	Gasoline....	1.5	325	Skid.....	6,700	9 ft 6 in.....	4 ft 0 in.....	6 ft 3 in.
4	Thermo-compression (Cleaver-Brooks).....	150	3,000	150	Gasoline....	1.5	325	Skid.....	6,800	11 ft 2 in.....	4 ft 2 in.....	5 ft 6 in.
5	Thermo-compression.....	300	6,000	200	Diesel.....	2.0	600	Skid.....	13,600	9 ft ½ in.....	5 ft 7 in.....	6 ft 4 in.

*The distillate capacity in gpd is calculated on the basis of the Corps of Engineers 20-hour day.

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d. Water Distribution Equipment.

Equipment	Capacity
Unit kitchen.....	5-gal cans, wt, 50 lbs (filled).
Unit kitchen.....	250-gal water tank trailer.
1-ton trailer.....	40 cans filled.
1½-ton truck.....	60 cans filled.
2½-ton truck.....	100 cans filled.
Water tank truck.....	700 gallons.
Water tank semitrailer.....	1,500 gallons.

e. Filter Unit Characteristics.

Unit	Type	Output (gpm)	Weight (tons)	Cubage (cu ft)
Knapsack-pack.....	Paper pads.....	¼	7 lb	1
Pack diatomite, No. 2.....	Diatomite.....	15	1.0	130
Portable diatomite, No. 3.....	Diatomite.....	35	1.8	160
No. 4.....	Diatomite.....	50	2.9	270
Stationary diatomite, No. 5.....	Diatomite.....	50	10.5	1,000
No. 6.....	Diatomite.....	200	28	1,800

f. Capacities of Other Water Supply Equipment.

Item	Capacity
Surface pump, centrifugal type 2-inch suction and discharge*.....	55 gpm against total head of 50 feet including 15-foot suction lift.
Shallow well pump, plunger type, 2½-inch*.....	10 gpm.
Deep well pumps:	
Plunger type, 2½ inch.....	10 gpm.
Turbine type, 6 inch.....	200 gpm against 200-foot head.
Air lift type.....	Variable.
Helical rotor type.....	60 gpm against 250-foot head.
Percussion well-drilling machine.....	4- to 6-inch well, 800 feet.
Rotary well-drilling machine.....	4- to 6-inch well, 1,000 feet.

*Larger pumps available in depot stock and in special units.

120. Adjutant General Supplies

	1	2	3	4	5
1	Item	Pounds per man per day	Short tons per 1,000 men per month	Measurement tons per 1,000 men per month	Sacks of mail per 1,000 men per month
	Forms and publications:				
2	Total, forms and publications.....	0.033	0.5	1.0	-----
	Postal:				
3	Letter mail ¹	² .024	.355	³ 1.98	17.8
4	Parcel post ⁴	.249	3.70	³ 16.78	151.0
5	Postal supplies.....	.011	.171	³ 0.6	-----
6	Total postal.....	.284	4.23	19.4	-----

¹ 60 percent moved by air during World War II; does not include V-Mail.

² Computed at 40 pounds per sack of mail (estimated).

³ Computed at 9 sacks per measurement ton (estimated).

⁴ Volume may be expected to increase 2.3 times during October and November due to Christmas mail.

⁵ Conversion factor 3.5 measurement tons per short ton (estimated).

121. Army Exchange Supplies—Consumption and Replenishment

	1	2	3	4
1	Item	Pounds per man per day	Short tons per man per month	Measurement tons per man per month
	Combat zone:			
2	Army in amphibious operations ¹	² 0.533	² 0.008	² 0.020
	Theater:			
3	Pacific ³ ⁴	1.571	.024	.050
4	European ⁴ ⁵	1.428	.021	.043

¹ Based on Operation OLYMPIC estimates, 150-day period.

² Does not include sundries pack issued with rations, 0.369 pound per man per day.

³ Southwest Pacific Theater planning data, 1945.

⁴ Data does not include items procured locally by individual exchanges.

⁵ ETO Board Report.

122. Paper Supply

1	Unit consumer	Consumption tons per day	Maximum production per day	Remarks
2	Radio Broadcast and Leaflet Gp ¹	2.5	1,000,000	5" x 8" leaflets printed both sides.
3	Radio Broadcast and Leaflet Gp ¹	2.5	500,000	8½" x 11" news sheets printed both sides.
4	Loudspeaker and Leaflet Co. ²	.7	270,000	5" x 7" leaflets printed both sides.
5	Loudspeaker and Leaflet Co. ²	.7	67,500	10" x 14" news sheets printed both sides.

¹ Based on press equipment authorized by TA 250-21, 16 Oct. 1950.

² Based on press equipment authorized by TOE 20-77, 1 Sep. 1950.

Section VII. REQUIREMENTS

123. Day of Supply—Definition

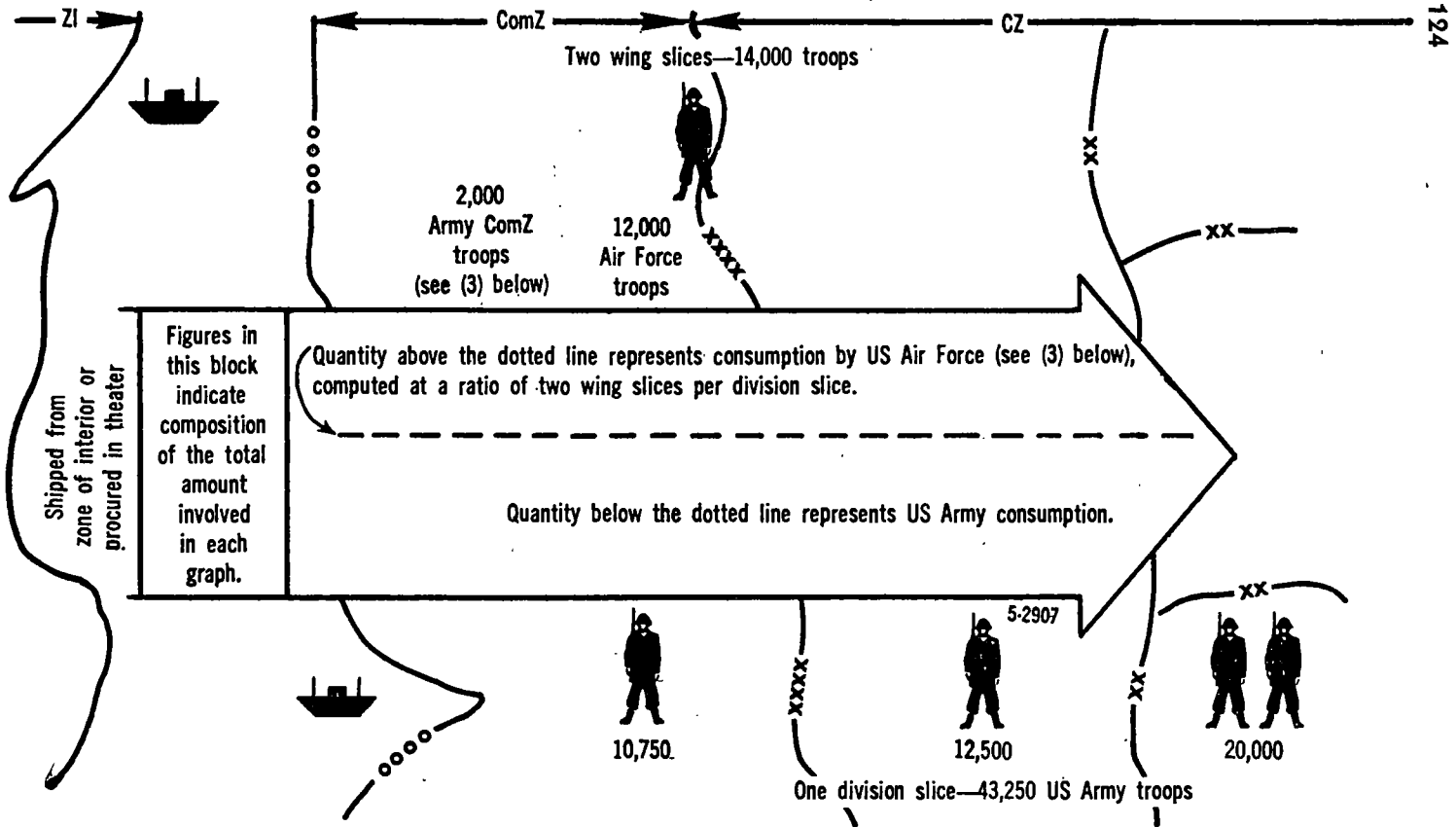
The day of supply, as used in this chapter, is the estimated weight of supplies required to support one man (soldier or officer, air plus ground) in an oversea theater for 1 day based on total strengths and maintenance tonnage experience over a long period of time. These factors are not considered as including initial equipment of troop units, but they do include tonnages for project equipment and similar supplies (other than civilian or other relief supplies) which are required to support troops. The tables shown in paragraphs 125 through 143, supplement the general consumption and flow charts of paragraph 124. They are based on historical data for specific locations, specific types of combat, and specific ground-to-air troop ratios.

124. General Consumption and Flow-Charts

a. *Introduction and Explanation of Graphs.*

- (1) This paragraph illustrates, with a series of six graphical charts and supporting tables, the flow of *maintenance supplies* from the zone of the interior or local procurement to consumer groups in the theater of operations.
- (2) The unit of measure, *tons per division slice*, is considered the most appropriate for long-range planning for supply of the Army and Air Force in a theater of operations. The division slice is defined (par. 52) as including "the strength of an average division plus proportionate shares of the total corps, army, communications zone, and theater overhead units." A troop location ratio has been assumed, illustrated by the human figures shown on following chart. Each figure represents approximately 10,000 of the 43,250 men making up the division slice. For illustrative purposes in these charts, it has been assumed that all divisions in the theater are occupying sectors along the front. In practice, varying proportions of these troops will be in reserve, in rest areas, in transit, or staging. Also shown, in a similar fashion, is the proportionate air strength in the theater, based on a ratio of two wing slices (defined in par. 53) per division slice.
- (3) The graphs include, in addition to the supplies consumed by the Army in the theater, the quantities of supplies brought into the theater for the use of the U. S. Air Force. All is shown in terms of tons per division slice per day. In all instances, figures based on Air Force strength include those Army troops, part of the wing slice, required within the theater because of the presence of Air Force elements

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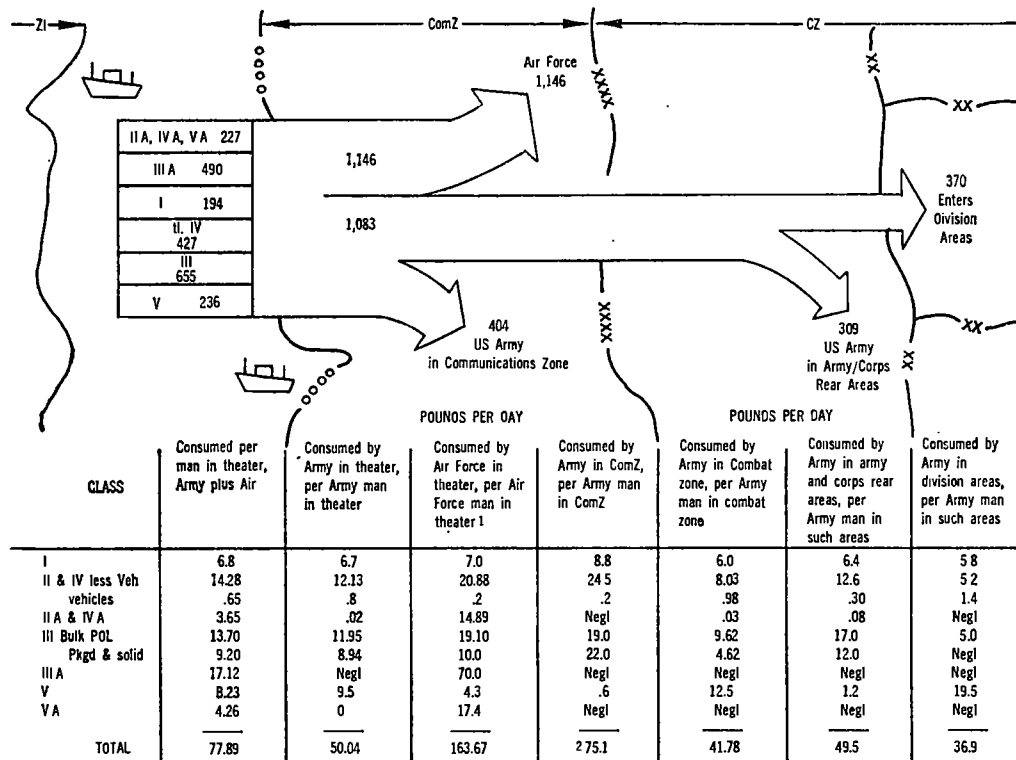


General Consumption and Flow Chart

requiring Army administrative support. To separate the quantity of supplies brought into the theater for the Army from those supplies brought in for the Air Force, a horizontal dotted line has been drawn.

- (4) The flow of supplies, in terms of tons per division slice per day, shown in each of the graphs is supported by *pounds per man per day* data displayed beneath each graph. These pounds per man per day figures *approximate* those found in the remainder of the chapter.
- (5) *Procurement in the theater* is indicated in each graph, except for classes V and VA, as a possible source of supply. The quantity thus available would decrease proportionately the amount to be procured from the zone of interior.
- (6) *Buildup of theater levels* is not included in this series of graphs. However, it can be determined easily by a fractional increase in the amounts shown. For example, if it is desired to establish a theater reserve of 30 days of supply, and accomplish this buildup in 120 days, a fractional increase of $30/120$ or one-fourth can be made in the amounts shown here.

b. Short Tons Per Division Slice Per Day—All Classes.



1 Includes Army troops required within the theater because of the presence of Air Force elements requiring Army administrative support.

2 This relatively greater figure is due to inclusion in this column of divisions to civilians, prisoners of war, and allies and miscellaneous theater-wide losses.

5-2907

Shipped from zone of interior or procured in theater

Rations and sundries 194

Air Force 49

US Army in Communications Zone 47

US Army in Army/Corps Rear Areas 40

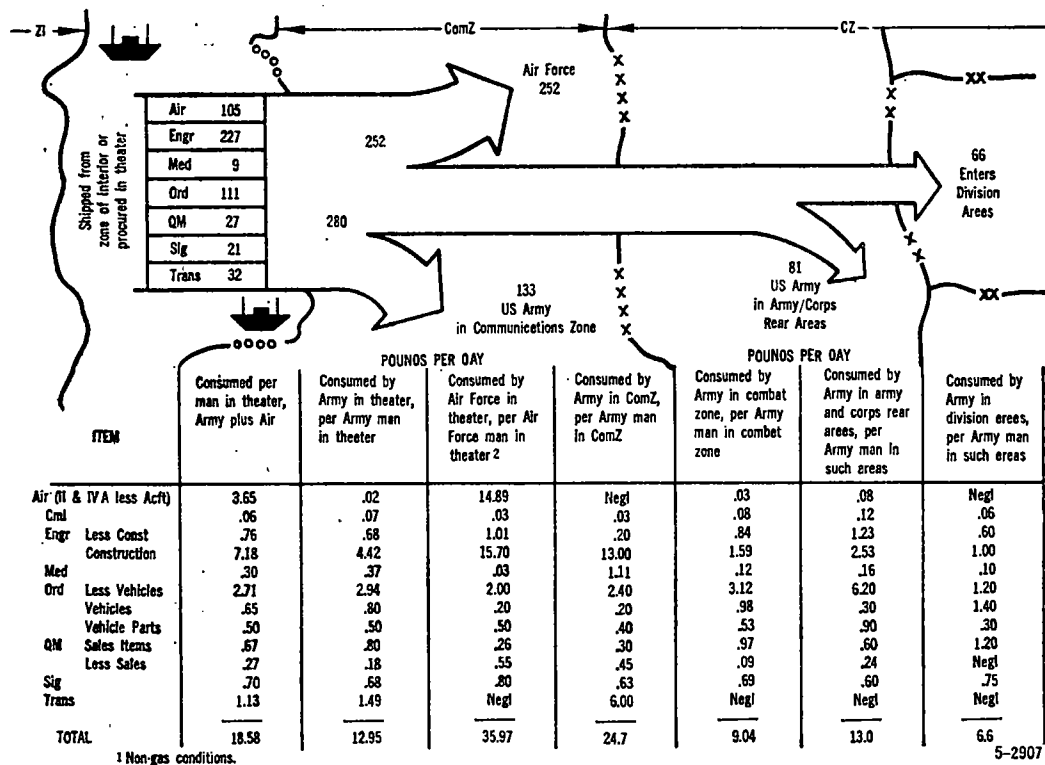
58 Enter Division Areas

ITEM	POUNDS PER DAY				POUNDS PER DAY		
	Consumed per man in theater, Army plus Air	Consumed by Army in theater, per Army man in theater	Consumed by Air Force in theater, per Air Force man in theater 1	Consumed by Army in ComZ, per Army man in ComZ	Consumed by Army in combat zone, per Army man in combat zone	Consumed by Army in army and corps rear areas, per Army man in such areas	Consumed by Army in division areas, per Army man in such areas
CLASS I	6.8	6.7	7.0	8.8	6.0	6.4	5.8

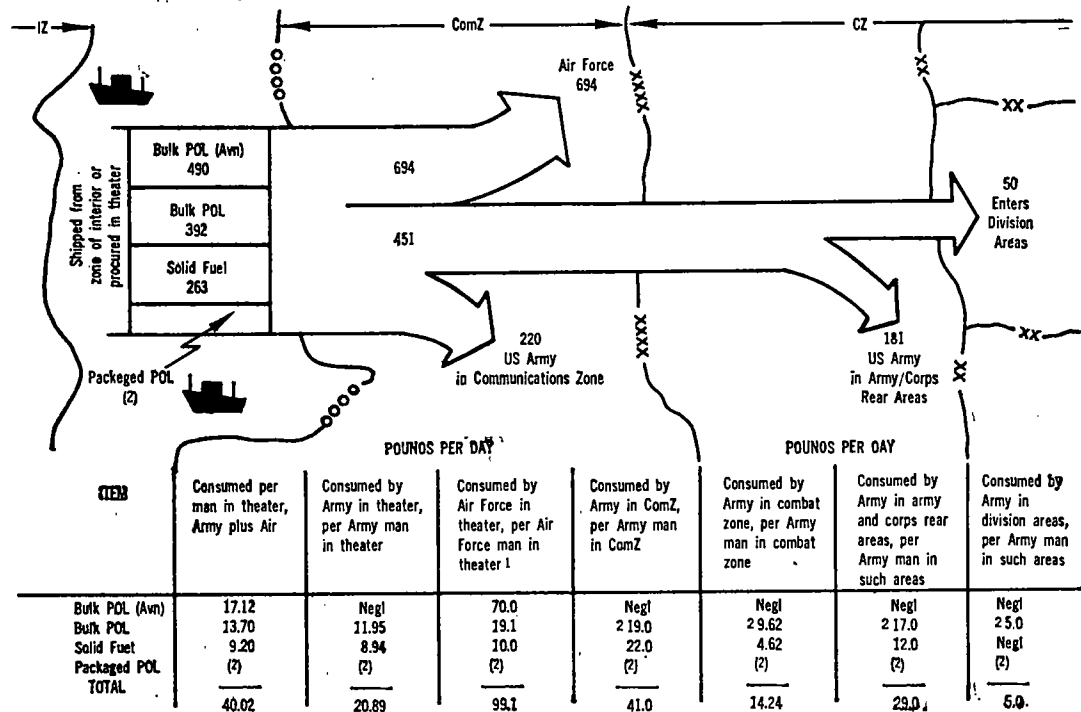
1 Includes Army troops required within the theater because of the presence of Air Force elements requiring Army administrative support.

2 This relatively greater figure is due to inclusion in this column of diversions to civilians, prisoners of war, and allies, and miscellaneous theater-wide losses.

d. Short Tons Per Division Slice Per Day—Classes II, IV, IIA and IVA.



e. Short Tons Per Division Slice Per Day—Classes III and IIIA.

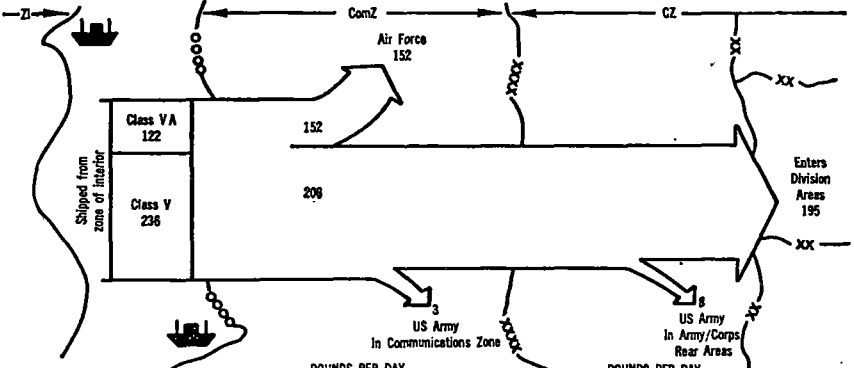


¹Includes Army troops required within the theater because of the presence of Air Force elements requiring Army administrative support.

²Due to the variety of means of distribution, bulk and packaged POL can not be segregated in this table.

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f. Short Tons Per Division Slice Per Day—Classes V and VA.



ITEM	POUNDS PER DAY				POUNDS PER DAY		
	Consumed per man in theater, Army plus Air	Consumed by Army in theater, per Army man in theater	Consumed by Air Force in theater, per Air Force man in theater ²	Consumed by Army in ComZ, per Army man in ComZ	Consumed by Army in combat zone, per Army man in combat zone	Consumed by Army in army and corps rear areas, per Army man in such areas	Consumed by Army in division areas, per Army man in such areas
Class V	8.23	9.5	4.3	.6	12.5	1.2	19.5
Class VA	4.26	0	17.4	Negl	Negl	Negl	Negl
TOTAL	12.49	9.5	21.7	.6	12.5	1.2	19.5

¹ Non-gas conditions.

² Includes Army troops required within the theater because of the presence of Air Force elements requiring Army administrative support.

5-2907

125. European Theater*

1	2	3	4	5	6
Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement-tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
Class I—Rations.....	7.170	0.108	2.1	0.227	0.261
Class II:					
Qm clothing and equipage.....	0.425	0.005	2.0	.012	.014
Qm general supplies.....	.305	.005	2.8	.014	.016
Ordnance vehicle replacement.....	.620	.009	2.2	.020	.023
Engineer.....	.630	.009	3.3	.030	.035
Ordnance.....	2.710	.041	1.8	.074	.085
Chemical.....	.025	.001	2.3	.002	.002
Signal (incl class IV).....	.725	.011	3.8	.042	.048
Medical (incl class IV and D).....	.300	.005	2.5	.013	.015
Total class II.....	5.740	.087		.207	.238
Class III:					
Gas, oil, grease ² (less AF).....	11.400	.171	1.5	.257	.296
AF fuel and lubricants ³	13.400	.201	1.5	.302	.347
Subtotal ⁴	24.800	.372		.559	.643
Fuel for temperate zone.....	8.500	.128	2.0	.256	.294
Total class III.....	33.300	.500		.815	.937
Class IV:					
Medical (incl in class II).....					
Ordnance motor maintenance.....	.510	.008	1.0	.008	.009
Qm sales items.....	2.000	.030	1.7	.051	.059
AF supply and replacement.....	2.840	.043	4.0	.172	.198
Engineer construction material.....	7.280	.109	1.5	.164	.189
Signal (incl in class II).....					
Chemical.....	Negligible				
Transportation.....	Negligible				
Total class IV.....	12.600	.190		.395	.455
Class V:					
Ammunition (less AF).....	3.640	.055	.9	.050	.058
AF ammunition.....	4.410	.066	.9	.059	.068
Total class V.....	8.050	.121		.109	.126
Total, European Theater.....	66.800	1.010		1.750	2.020

*Nongas conditions.

¹ Conversion factors are based on average cubage for each item. Measurement ton (40 cu ft) of any one item can be found by multiplying its short ton (2,000 lb) weight by that item's conversion factor.

² Consists of the following:

- 90 percent gasoline.
- 4 percent Diesel fuel.
- 3 percent engine oil.
- 1 percent gear lubricant.
- 2 percent greases.

³ Class IIIA.

⁴ Assume 90 percent of quantities shown in this line is shipped by tanker and 10 percent is shipped in packaged containers as dry cargo.

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126. Pacific Theater*

	1	2	3	4	5	6
	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measurement-tons ¹	Measurement tons per man per month	Measurement tons per man per month with 15% stowage
1						
2	Class I—Rations.....	6.710	0.101	2.1	0.212	0.244
3	Class II:					
4	Qm clothing and equipage.....	1.000	.015	2.0	.030	.036
5	Qm general supplies.....	.730	.011	2.8	.031	.036
6	Ordnance vehicle replacement.....	.620	.009	2.2	.020	.023
7	Engineer.....	.370	.006	3.3	.020	.023
8	Ordnance.....	.300	.005	1.8	.009	.010
9	Chemical (incl class IV).....	.567	.009	2.3	.021	.024
10	Signal (incl class IV).....	.750	.011	3.8	.042	.048
11	Medical (incl class IV and I).....	.3330	.005	2.5	.013	.015
12	Total class II.....	4.670	.071		.186	.214
13	Class III:					
14	Gas, oil, grease ² (less AF).....	10.800	.162	1.5	.243	.279
15	AF fuel and lubricants ³	11.080	.166	1.5	.249	.286
16	Subtotal ⁴	21.900	.328		.492	.565
17	Fuel for temperate zone.....	8.500	.128	2.0	.256	.294
18	Total class III.....	30.400	.456		.748	.869
19	Class IV:					
20	Medical (incl in class II).....					
21	Ordnance motor maintenance.....	.180	.003	1.0	.003	.003
22	Qm sales items.....	1.970	.030	1.7	.051	.059
23	AF supply and replacement.....	2.840	.043	4.0	.172	.198
24	Engineer construction material.....	11.900	.179	1.5	.268	.308
25	Signal (incl in class II).....					
26	Chemical (incl in class II).....					
27	Transportation.....	.130	.002	2.4	.005	.006
28	Total class IV.....	17.000	.267		.499	.574
29	Class V:					
30	Ammunition (less AF).....	5.140	.077	.9	.070	.081
31	AF ammunition.....	3.470	.052	.9	.047	.054
32	Total class V.....	8.610	.129		.117	.135
33	Total, Pacific Theater.....	67.4	1.010		1.760	2.030

* Nongas conditions.

¹ Conversion factors are based on average cubage for each item. Measurement tons (40 cu ft) of any one item can be found by multiplying its short ton (2,000 lb.) weight by that item's conversion factor.² Consists of following:

- 63 percent gasoline.
- 31 percent diesel fuel.
- 3 percent engine oil.
- 1 percent gear lubricant.
- 2 percent greases.

³ Class IIIA.⁴ Assume 90 percent of quantity shown in this line is shipped by tanker and 10 percent is shipped in packaged containers as dry cargo.

127. Polar Regions*

	1	2	3	4	5	6
1	Item	Pounds per man per day	Tons per man per month	Conversion factor short tons to measure- ment tons ¹	Measure- ment tons per man per month	Measure- ment tons per man per month with 15% stowage
2	Class I--Rations.....	10.40	0.156	2.1	0.328	0.377
	Class II:					
3	Qm clothing and equipage.....	.85	.013	2.9	.038	.044
4	Qm general supplies.....	.40	.006	2.8	.017	.020
5	Ordnance vehicle replacement.....	.62	.009	2.2	.020	.023
6	Engineer.....	.84	.013	3.3	.043	.049
7	Ordnance.....	2.00	.030	1.8	.054	.062
8	Chemical (incl class IV).....	.03	Negligible	2.3	.001	.001
9	Signal (incl class IV).....	.66	.010	3.8	.038	.044
10	Medical (incl class IV).....	.40	.006	2.5	.015	.017
11	Total class II.....	5.8	.087		.226	.260
	Class III:					
12	Gas, oil, grease, compounds.....	9.0	.135	1.5	.203	.233
13	AF fuel and lubricants ²	14.0	.210	1.5	.315	.362
14	Fuel, solid.....	18.50	.277	2.0	.555	.638
15	Total class III.....	41.5	.622		1.073	1.233
	Class IV:					
16	Medical (incl in class II).....					
17	Ordnance motor maintenance.....	.5	.008	1.0	.008	.009
18	Qm sales items.....	2.0	.030	1.7	.051	.059
19	AF supply and replacement ³	3.5	.052	4.0	.208	.239
20	Engineer const. material.....	12.0	.180	1.5	.270	.310
21	Signal (incl in class II).....					
22	Chemical (incl in class II).....					
23	Total class IV.....	18.0	.270		.537	.618
	Class V:					
24	Ammunition.....	1.8	.027	0.9	.024	.028
25	AF ammunition ⁴	3.5	.052	0.9	.047	.054
26	Total class V.....	5.3	.079		.071	.082
27	Total.....	81.0	1.22		2.24	2.58

*Estimated, based on Arctic test operations.

¹ Conversion factors are based on average cubage for each item. Ship tons (40 cu ft) of any one item can be found by multiplying its short ton (2,000 lb) weight by that item's conversion factor.

² Class IIIA.

³ Classes IIA and IVA.

⁴ Class VA.

128. Combat Zone and Communications Zone

1	Item	2	3	4
		Pounds per man per day		
		Per army man in combat zone, continental land mass ¹	Per army man in combat zone, jungle ²	Per army man in communications zone ³
2	Class I.....	7.69	5.95	8.80
3	Classes II and IV:			
4	Air.....	.023	.016	Negligible
5	Cml.....	.040	.090	.030
6	Eng.....	2.49	8.95	13.2
7	Med.....	.112	.560	1.11
8	Ord.....	4.95	.860	3.00
9	Qm.....	.928	1.35	.75
10	Sig.....	.973	.346	.63
11	Trans.....	Negligible	Negligible	6.00
12	Total II and IV.....	9.52	12.2	24.7
13	Class III.....	12.0	7.53	41.0
14	Class V.....	13.4	8.68	1.40
15	Total.....	42.6	34.4	75.9

¹ Based on operations in Europe, all armies, 24 February 1945 to 28 March 1945.

² Based on Sixth and Eighth Army operations, December 1943 to September 1944.

³ Assumed from theater averages, World War II.

129. Field Army and Corps in Combat

1	Item	2	3
		Short tons per day	
		Per field army ¹	Per corps ²
2	Class I.....	1,420	346
3	Classes II and IV:		
4	Air.....	.133	Negligible
5	Cml.....	7.4	1.8
6	Engr.....	461	112
7	Med.....	20.7	5
8	Ord.....	916	223
9	Qm.....	172	41.8
10	Sig.....	180	43.8
11	Total II and IV.....	1,760	427
12	Class III.....	2,220	540
13	Class V ³	3,200	800
14	Total.....	8,600	2,113

¹ Computed for field army of 3 corps, each corps composed of 3 infantry and 1 armored division, and including necessary supporting and service elements.

² Computed for corps of 3 infantry divisions and 1 armored division, with necessary supporting and service elements.

³ Class V data applicable for periods of 14 days or more.

130. Airborne Division in Airborne Assault*

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	6.60	57
3	Classes II and IV:		
3	Cml.....	0	0
4	Engr.....	1.00	9
5	Med.....	.42	4
6	Ord.....	0	
7	Qm.....	0	
8	Sig.....	1.04	9
9	Total II and IV.....	2.46	22
10	Class III.....	1.70	15
11	Class V:		
11	Cml.....	.20	2
12	Ord.....	41.0	351
13	Total V.....	41.2	353
14	Total.....	52.0	447

*Nongas conditions.

131. Armored Division in Attack*

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.37	40
3	Classes II and IV:		
3	Cml.....	.25	2
4	Engr.....	.70	5
5	Med.....	30	2
6	Ord.....	*14.10	104
7	Qm.....	2.11	16
8	Sig.....	0.87	6
9	Total II and IV.....	18.30	135
10	Class III.....	13.80	102
11	Class V.....	50.0	369
12	Total.....	87.5	646

*Primarily battle losses of combat vehicles.

132. Armored Division in Pursuit and Exploitation*

	1	2	3
1	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.61	41
	Classes II and IV:		
3	Cml.....	.25	2
4	Engr.....	.54	4
5	Med.....	.30	2
6	Ord.....	2.14	16
7	Qm.....	2.11	16
8	Sig.....	.85	6
9	Total II and IV.....	6.19	46
10	Class III.....	23.30	172
11	Class V.....	8.8	65
12	Total.....	43.9	324

133. Armored Division in Defense*

	1	2	3
1	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.61	41
	Classes II and IV:		
3	Cml.....	.25	2
4	Engr.....	.42	3
5	Med.....	.15	1
6	Ord.....	2.00	15
7	Qm.....	2.11	16
8	Sig.....	.37	3
9	Total II and IV.....	5.30	39
10	Class III.....	7.61	56
11	Class V.....	53.2	393
12	Total.....	71.6	528

*Nongas conditions.

134. Armored Division in Reserve*

	1	2	3
1	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.51	41
	Classes II and IV:		
3	Cml.....	.25	2
4	Engr.....	.21	2
5	Med.....	.15	1
6	Ord ¹	2.50	19
7	Qm ¹	2.25	17
8	Sig.....	.37	3
9	Total II and IV.....	5.73	42
10	Class III.....	5.83	43
11	Total V ²		
12	Total.....	17.3	128

¹ Increase over inactive situation due to intensified maintenance and replacement activities.² All elements of division out of combat.**135. Infantry Division in Attack of Fortified Position***

	1	2	3
1	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.72	50
	Classes II and IV:		
3	Cml.....	.251	2
4	Engr.....	2.13	19
5	Med.....	.301	3
6	Ord.....	1.67	15
7	Qm.....	.942	8
8	Sig.....	.959	8
9	Total II and IV.....	6.25	55
10	Class III.....	4.93	43
11	Class V.....	47.8	419
12	Total.....	64.7	567

*Nongas conditions.

136. Infantry Division in Attack of Deliberately Organized Position*

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.37	47
3	Classes II and IV:		
4	Cml.....	.252	2
5	Engr.....	.843	7
6	Med.....	.301	3
7	Ord.....	1.67	15
8	Qm.....	.929	8
9	Sig.....	.991	9
9	Total II and IV.....	4.98	44
10	Class III.....	7.92	69
11	Class V.....	44.4	389
12	Total.....	62.7	549

137. Infantry Division in Attack of Hastily Organized Position*

	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.46	48
3	Classes II and IV:		
4	Cml.....	.051	0.5
5	Engr.....	1.26	11
6	Med.....	.125	1
7	Ord.....	2.83	25
8	Qm.....	.938	8
9	Sig.....	.961	8
9	Total II and IV.....	6.16	54
10	Class III.....	8.47	74
11	Class V.....	42.8	375
12	Total.....	62.9	551

*Nongas conditions.

138. Infantry Division in Covering, Security Force, Retirement, or Delaying Action*

	1	2	3
1	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.42	48
3	Classes II and IV:		
4	Cml.....	.381	3
5	Engr.....	.811	7
6	Med.....	.121	1
7	Ord.....	1.47	13
8	Qm.....	1.32	12
9	Sig.....	.721	6
10	Total II and IV.....	4.80	42
11	Class III.....	12.5	110
12	Class V.....	26.1	229
	Total.....	48.8	427

139. Infantry Division in Pursuit*

	1	2	3
1	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.61	49
3	Classes II and IV:		
4	Cml.....	.091	1
5	Engr.....	.879	9
6	Med.....	.111	1
7	Ord.....	2.08	18
8	Qm.....	.659	6
9	Sig.....	.710	6
10	Total II and IV.....	4.63	41
11	Class III.....	15.3	134
12	Class V.....	7.7	67
	Total.....	33.2	291

*Nongas conditions.

140. Infantry Division in Assault of Hostile Shore*

	1	2	3
1	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	6.19	54
3	Classes II and IV:		
4	Cml.....	.191	2
5	Engr.....	1.17	10
6	Med.....	.221	2
7	Ord.....	.769	7
8	Qm.....	.502	4
9	Sig.....	.389	3
10	Total II and IV.....	3.24	28
11	Class III.....	4.56	40
12	Class V.....	43.3	379
	Total.....	57.3	502

141. Infantry Division in Defense of Position*

	1	2	3
1	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.51	48
3	Class II and IV:		
4	Cml.....	.361	3
5	Engr.....	1.46	13
6	Med.....	.221	2
7	Ord.....	1.50	13
8	Qm.....	1.10	10
9	Sig.....	.989	9
10	Total II and IV.....	5.63	49
11	Class III.....	6.83	60
12	Class V.....	50.0	438
	Total.....	70.0	613

*Nongas conditions.

142. Infantry Division in Inactive Situation*

1	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.19	46
3	Class II and IV:		
4	Cml.....	.251	2
5	Engr.....	.501	4
6	Med.....	.151	1
7	Ord.....	.829	7
8	Qm.....	2.11	19
9	Sig.....	.479	4
10	Total II and IV.....	4.32	38
11	Class III.....	6.41	50
12	Class V*.....	16.2	142
	Total.....	32.1	281

*All elements out of combat.

143. Infantry Division in Reserve*

1	1	2	3
	Item	Pounds per man per day	Short tons per division per day
2	Class I.....	5.38	47
3	Classes II and IV:		
4	Cml.....	.251	2
5	Engr.....	.159	1
6	Med.....	.161	1
7	Ord.....	1.25	11
8	Qm.....	2.11	19
9	Sig.....	.479	4
10	Total II and IV.....	4.40	39
11	Class III.....	2.23	20
12	Class V*.....		
	Total.....	12.0	105

*All elements out of combat.

*Nongas conditions.

144. Supply by Air

a. *General.* General procedures for aerial supply are contained in FM 57-30, and paragraphs 235 through 239 of this manual. Normally specific instructions for supply by air in an area of operations are issued within the theater concerned.

b. *Infantry and Armored Divisions.* Aerial supply of infantry and armored divisions will be required most often in connection with exploitation operations or when ground lines of communications are limited or subject to prolonged enemy interference. A specific situation or operation will dictate the overall tonnages required. Requirements are based on data in tables in paragraphs 131 through 141. Aerial supply of the infantry division, part of an airborne force, will follow those procedures applicable to the airborne division.

c. *Airborne Forces.* Two days of automatic followup supply and two or three days of on call followup supply normally are prepackagd for an assault airborne division to enable the division to continue operations until more normal supply procedures can be adopted. Requirements will be based on the phasing of the division into the airhead and table in paragraph 130. Requirements for an air-landed infantry division will be based on the type and duration of the anticipated action, the phasing of the division into the airhead, and tables in paragraphs 135 through 141.

Section VIII. PROCUREMENT

145. Procurement Lead Times ^{1 2}

Class I ³	12-18 months
Class II:	
Civilian-type articles	2-12 months
Military-type articles	6-24 months
Class III	3 months
Class IV:	
Civilian-type articles	2-12 months
Military-type articles	6-24 months
Class V	6-24 months

¹ From time of order to time of delivery in zone of interior.
² Theaters must add order and shipping time.
³ To account for seasonal items.

Section IX. STORAGE

146. Definition of Terms

An understanding of the following terms is necessary in order to be able to use the data listed in this chapter in determining storage area requirements.

a. *Storage Space.* Any space, without regard to type of construction or improvement, used for storage.

b. *Storage Building.* Any building constructed or acquired for the storage of supplies, even though some part of it has been diverted to and is used for office, depot utility storage, or repair shops. Buildings constructed or acquired for office buildings, repair shops, depot utility storage buildings, except when they are used in whole or in part for the storage of supplies, are not considered storage buildings. The actual area used for storage purposes within such a building is considered storage space for reporting purposes.

(1) *Warehouse.* A building designed or designated for storage purposes when constructed with roof and complete side and end walls. It may be one story or more, built at ground level or elevated to car or truck height. Presence or absence of outside loading platforms has no bearing on the classification.

(2) *Heated warehouse.* Warehouse in which the temperature may be controlled within specified limits by the application of heat.

(3) *Unheated warehouse.* Warehouse in which no provision has been made for heat.

(4) *Humidity controlled warehouse.* Warehouse in which the humidity is controlled within specified limits

(5) *Inflammable warehouse.* Space within a building specially designated for the storage of highly inflammable materials. (Inflammable materials are those which present fire hazards.)

(6) *Shed.* A building normally without side or end walls. A building originally constructed as a shed and subsequently closed with side and end walls becomes a warehouse upon completion of alterations and will be reported as such.

(7) *Other covered space.* A building or portion of a building other than warehouse which is used for storage of supplies even though some part of it is used for offices, depot utility storage, repair shops, etc. The actual area used for storage purposes within such a building is considered storage space.

c. *Gross Storage Space.* The entire inside area of covered storage space, determined by using inside dimensions of building; the overall area of open storage space with no deductions for trackage and permanent roads; the actual storage space (pads) for open ammunition or toxic space.

d. *Bin Storage.* That space in which storage bins or stock racks have been erected. It includes aisles and working spaces between

bins. Box pallets and pallet racks are not bins and the area occupied by them is not bin area.

e. Aisles. Any passageways within a storage area. Aisle space in bin areas will not be included (see above).

f. Receiving and Shipping Space. Gross space designated as work area for receipt and shipment of supplies and equipment.

g. Nonstorage Space. That area within gross space which is not used for storage because of structural losses or designation for other than storage purposes. Includes transit shed space when used or reserved for that purpose.

h. Net Usable Space. That portion of total gross space on which supplies can actually be stored. It does not include bin storage space, aisles, or receiving and shipping space.

i. Open Space. Ground area used for storage of supplies and materiel other than area used for shop stock, operating supplies, and utility supplies for use in the reporting installation. It may be a specially prepared area, an improved area or an open area in use for storage in lieu of regular storage area. Open storage space is designated under three headings as follows: improved, semi-improved, and unimproved.

- (1) *Improved.* Area having a paved, well-drained surface (asphalt, concrete and well-prepared, water-bound macadam are examples) or area which has been prepared with topping of some suitable material, or which, because of the nature of the ground (gravel or shale) and special preparation (rolling, draining, grading) gives a surface which permits vehicular traffic and year-round storage operations under ordinary circumstances and which lends itself to the storage of supplies on dunnage, "without danger of sinking of stacks." The fact that during certain seasons operations may be limited, because of weather conditions, does not change the category for reporting purposes. Improved space will include all trackage and permanent roads within the improved area.
- (2) *Semi-improved.* A partially prepared open storage area which is graded and prepared with topping of some suitable material, but which is not hard-surfaced. Semi-improved space will include all trackage and permanent roads within the semi-improved area.
- (3) *Unimproved.* Other open area which is in use for the storage of supplies, but which has not been surfaced for storage purposes.

j. Magazine (including "Igloo"). Storage structures above or below ground, constructed for the storage of ammunition and explosives. These structures will be reported as magazines regardless of whether ammunition and explosives are actually stored in them. The *only* circumstances under which magazines will be reported under warehouse space is when the magazine has been designated as "inflammable material space" in accordance with definition heretofore. Conversely, warehouses containing ammunition will not be reported as magazines. Occupancy of magazines will be computed to include that area utilized as access aisle space contiguous to materials stored. The remainder unoccupied will be reported as vacant.

k. Tank. Space in tanks designated for the storage of supplies other than petroleum products.

l. Ammunition and Toxics. Ground area prepared or improvised for storage of ammunition or toxics in open area to supplement magazine space. It consists of prepared or improvised surfaces with or without roofing or barricaded sides. The gross area of this space includes only the actual open storage space (pads) prepared or improvised for storage. It does not include surrounding area restricted for storage because of safety-distance factors.

m. Cold Storage Warehouse. Space in which a controlled temperature below 50° may be maintained.

- (1) Chill-cold storage space with temperature controlled between a maximum of 50° and a minimum of 32°.
- (2) Freezer-cold storage space with temperature controlled below 32°.

n. Allocated Space. Is space formally apportioned to the heads of administrative and technical services by the Deputy Chief of Staff for Logistics. (Assignment of allocated storage space within a storage installation is the responsibility of the chief of the administering agency.) (See AR 700-12.)

o. Dispersed Storage Areas. Those portions of a depot or sub-installation that are geographically located away from the main establishment, but not at another reporting installation.

p. Subinstallations. Those establishments so designated by Department of the Army directives.

q. Site Area.

- (1) Site area, in covered storage, is the total land area required for buildings, spaced at minimum distances, plus all the necessary operating areas such as access roads, depot roads, railway sidings, and truck parks.

- (2) Site area, in open storage, is the total land surface required for net usable general storage area as defined above, plus that additional area required to fulfill safety regulations and to properly operate the storage facility as a whole.

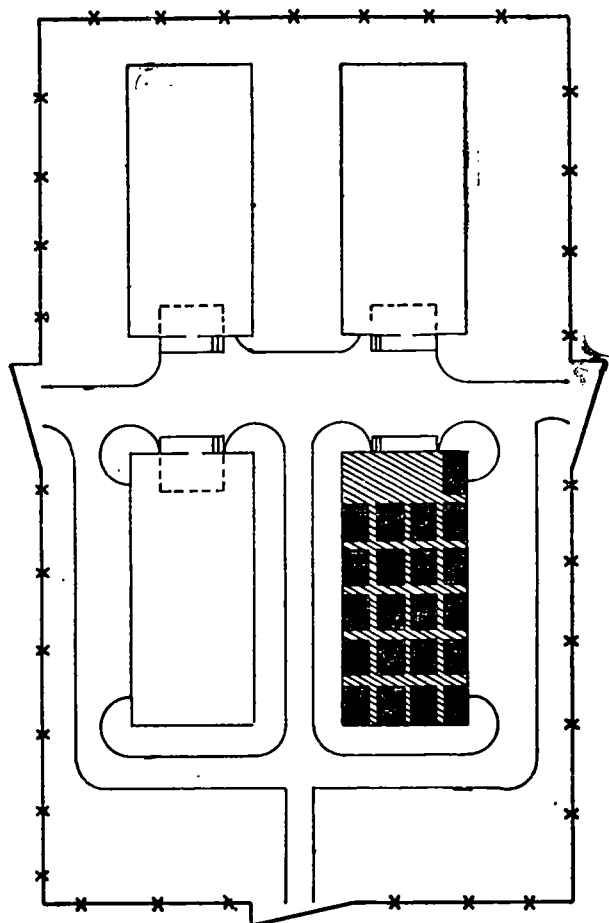
r. Gross Storage Area Factor. The gross storage area factor is the ratio of the gross storage area to the net usable general storage area. After the net usable general storage area requirement, as described above, has been determined, the gross storage area requirement is obtained by multiplying the net usable general storage area value by the pertinent gross storage area factor, as follows:

$$\text{Net usable general storage area} \times \text{gross storage area factor} = \text{gross storage area.}$$

s. Site Area Factor. The site area factor is a ratio of the site area to the gross storage area. Having determined the gross storage area requirement, the site area requirement is obtained by multiplying the gross storage area value by the pertinent site area factor as follows:

$$\text{Gross storage area} \times \text{site area factor} = \text{site area.}$$

t. Illustrating Diagram.



K E Y

-  = Net Usable Storage Area
 +  = Gross Storage Area (in covered storage, the building)
 +  +  = Site Area

147. Storage Factors

a. The following table gives optimum storage tonnage area requirements for support of military operations. These data are for general

planning purposes only and may vary greatly as a result of climate conditions or the tactical situation.

	I	2	3	4	5	6	7	8
1	Class	Consumed per man in theater Army plus AF short tons/man/month	Percent of tons of supplies stored		Tons/man/month of supplies stored		Gross storage area/man/month of supply	
			Covered	Open	Covered short tons	Open short tons	Covered sq. ft.	Open sq. ft.
2	I.....	.01005	60	40	.0603	.0402	.0910	.803
3	II, IV, IIA, and IVA: Air (IIA and IVA less aircraft).	.0390	(Storage provided in air depot)					
4	Chemical.....	.0009	70	30	.0006	.0003	.011	.009
	Engineer:							
5	Less construction.....	.0095	20	80	.0019	.0076	.023	.152
6	Construction.....	.1092	10	90	.0109	.0983	.126	1.875
7	Medical.....	.0045	90	10	.0040	.0005	.080	.012
	Ordnance:							
8	Less vehicles.....	.0407	20	80	.0081	.0326	.120	.644
9	Vehicles.....	.0102	0	100	.0000	.0102	.000	.276
10	Vehicle parts.....	.0077	40	60	.0031	.0046	.048	.124
	Quartermaster:							
11	Sales items.....	.0110	90	10	.0099	.011	.133	.030
12	Less sales.....	.0041	90	10	.0037	.0004	.050	.011
13	Signal.....	.0110	70	30	.0077	.0033	.210	.045
14	Transportation.....	.0020	5	95	.0001	.0019	.001	.034
	III and IIA:							
15	Bulk POL (Avn).....	.1380	(Tank Farm)					
16	Bulk POL.....	.1455	(Tank Farm)					
17	Solid fuel.....	.1320	0	100	.0000	.1320	.000	2.640
18	Packaged POL.....	.0135	10	90	.0014	.0121	.021	.327
19	V and VA: V (including 10% of VA)*..	.1304	10	90	.0130	.1174	.195	2.350
20	VA.....	.0527	(Storage provided in air depot)					
21	Totals.....	.9624			.01203	.04669	1.762	9.763
22	O1, II, III (Pkgd) and IV.....	.3248	33	67	.1073	.4669	1.567	4.763
23	O1 III Solid Fuels.....	.1320	0	100	.0000	.1320	.000	2.640
24	O1 V.....	.1304	10	90	.0130	.1174	.195	2.350

*Army supporting Air will store small arms ammunition which is estimated to be 10 percent of total.

b. Average ratio of gross storage area, open to covered, by classes of supply.

	Ratios of gross storage area open to covered	
All classes (except bulk POL).....	5.5	1
C 1 I, II, III (Pkgd and Solid), and IV.....	4.7	1
C 1 I, II, III (Pkgd), and IV.....	3	1
C 1 V (including 10 percent of V-A).....	12	1

148. Storage Space Conversion Factors

The following table indicates the net usable general storage area (sq ft) occupied per short ton:

1	1	2	3	4	5
	Branch	Type of storage			
		Covered storage	Open storage	Igloo and magazine	Open storage ammunition
2	Ordnance Corps.....	10.0	18.0	7.0	11.0
3	Signal Corps.....	10.0	16.0		
4	Corps of Engineer.....	8.0	13.0		
5	Chemical Corps.....	12.5	20.8	7.0	11.0
6	Army Medical Service.....	13.0	16.0		
7	Quartermaster Corps.....	9.0	17.1		
8	Transportation Corps.....	7.0	12.0		
9	Adjutant General's Corps.....	10.0			

149. Average Stack Heights*

- a. *Covered Storage.* All services 8 ft.
 b. *Open Storage.* All services 6 ft.

150. Gross Storage and Site Area Factors

1	1	2	3	4	5	6
	Class of supply	Services	Gross storage area factors ¹		Site area factors ²	
			Covered	Open	Covered	Open
2	I.....	Quartermaster.....	1.40	1.50	2.00	1.50
3	II.....	All services.....	1.25	1.30	1.80	1.43
4		Ordnance.....	2.00	2.00	3.00	3.00
5		Quartermaster.....	1.40	1.50	2.00	1.50
6		Signal.....	2.00	2.20	1.80	1.43
7	III.....	Quartermaster.....	1.25	1.30	1.80	1.43
8	IV.....	All services.....	1.25	1.30	1.80	1.43
9		Ordnance.....	2.00	2.00	3.00	3.00
10		Quartermaster.....	1.40	1.50	2.00	1.50
11		Signal.....	2.00	2.20		
12	V.....	Ordnance and chemical.....	1.25	1.25	⁴ 112.00	(⁵)

¹ Apply additional factor of 3 for storage in combat zone.

² Apply additional factor of 5 for storage of classes I, II, III, and IV in the combat zone.

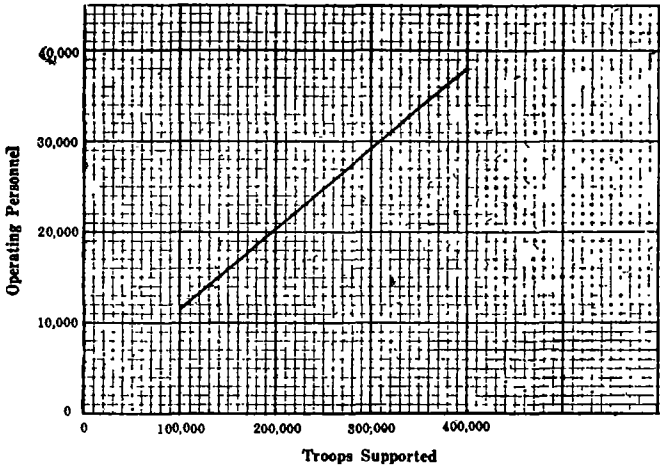
³ Excludes bulk storage of petroleum in tanks.

⁴ These factors take into consideration the great amount of dispersion necessary as a safety precaution in storing ammunition.

⁵ See par. 152.

*Figures given are for use in theaters. For zone of interior storage, increase by 25 percent.

151. Operating Personnel Required for all Storage Within a Theater*



152. Miscellaneous Factors

- Ammunition storage per mile of road ¹----- 1,000 short tons.
- Ammunition storage per square mile ¹----- 5,000 short tons.
- Minimum hard standing requirements for 2,500 vehicles ² 110,000 sq. ft.
- Solid footing for vehicle park for 2,500 vehicles----- 4,000,000 sq. ft.
- Minimum hard standing requirement for artillery and 350 sq. ft.
- combat vehicles, per item.

¹ Refers to temporary storage of ammunition along roadways and in urban fields and forests much as may be found in combat zones.

² Data based on the assumption that hard standing area will not be required for the total number of vehicles at any one time.

153. Handling of Supplies

a. Labor Requirements.

- (1) *Hand operations.* For long-term planning purposes, labor requirements for handling supplies by hand are computed on the average of one-half ton per man per hour for 10 hours each day. For short periods, the average is much higher.
- (2) *Mechanical handling.* For planning purposes, the labor requirements for handling supplies by use of mechanical equipment, such as fork-lift trucks and tractor-trailer trains, are normally limited to a working foreman and equipment operators to operate the mechanical equipment necessary to efficiently handle these supplies.

b. Handling Crews.

- (1) *Hand operations.* The maximum number of men that may be employed advantageously in loading or unloading one freight car is nine (one working foreman and eight laborers).

*May include prisoners of war and civilians as available.

The maximum crew for loading or unloading average loads by hand on Army trucks is five men (one working foreman and four laborers).

- (2) *Mechanical handling of palletized loads.* The maximum number of men required to advantageously load or unload one freight car or truck of palletized supplies using mechanical handling equipment is three (one working foreman and two materials handling equipment operators).

c. *Time Estimate* (based on manual handling).

- (1) The time estimate for average packaged or bundled military loads³ at depots, supply points, or using units, under average conditions, a 5-man crew for each truck or trailer, and the number of trucks or trailers to be loaded or unloaded simultaneously, dependent upon amount of labor available, is as follows:

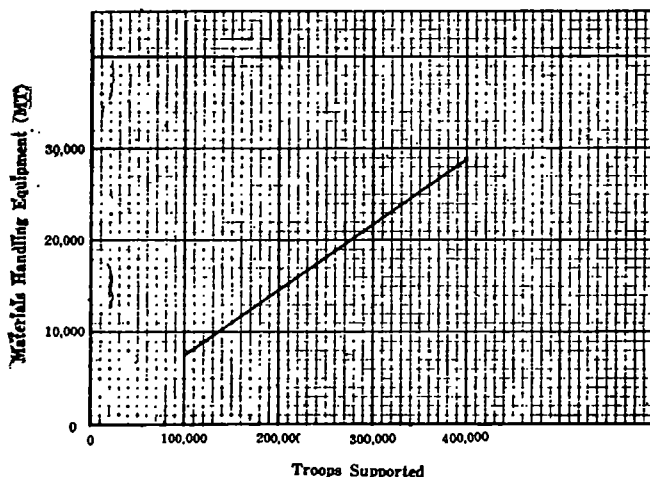
<i>Loading and unloading</i>	<i>2½-ton truck</i>	<i>1½-ton trailer</i>
Average time-----	50 min----	20 min.
Minimum time-----	30 min----	12 min.

- (2) For prescribed loads, under field conditions, where the amount of labor available is unlimited:

	<i>Day</i>	<i>Night</i>
Unloading-----	15 min----	30 min.
Loading-----	30 min----	60 min.

154. Materials Handling Equipment Requirements

A depot supplying 100,000 men will require approximately 7,700 measurement tons of materials handling equipment, including conveyors, pallets, scales, tractors, trailers, forklift trucks, hand-trucks, lumber-straddle trucks, stock-picker trucks, etc.



³ See chapter 7 regarding authorized 100 percent overload for certain vehicles under some conditions and double time estimates when necessary.

155. Illustrative Problems

a. Situation, Problem A. To determine storage requirements for a theater of operations requiring 100,000 measurement tons of class I supplies.

b. Solution, Problem A. Storage area requirements:

A measurement ton (MT) = 40 cu ft.

Therefore, $100,000 \text{ MT} \times 40 = 4,000,000$ cu ft of supplies to be stored.

Minimum percentage of covered storage required is 60 percent (see par. 147).

Therefore, 40 percent open storage required.

$60 \times 4,000,000 \text{ cu ft} = 2,400,000$ cu ft of supplies requiring covered storage.

$40 \times 4,000,000 \text{ cu ft} = 1,600,000$ cu ft of supplies to be stored in the open.

Average stack heights (see par. 149):

Covered storage = 8 feet.

Open storage = 6 feet.

$2,400,000 \text{ cu ft} \div 8 \text{ ft} = 300,000 \text{ sq ft}$, net usable area of covered storage required.

$1,600,000 \text{ cu ft} \div 6 \text{ ft} = 267,000 \text{ sq ft}$, net usable area of open storage required.

Gross storage areas for each type of storage are based on net usable areas. Factors for computations, as found in paragraph 150, are—

Covered storage = 1.40

Open storage = 1.50

(Assume storage is to be in communications zone; hence additional combat zone factor of 3 is not required.)

$300,000 \text{ sq ft} \times 1.40 = 420,000 \text{ sq ft}$, gross storage area required for covered storage.

$267,000 \text{ sq ft} \times 1.50 = 400,500 \text{ sq ft}$, gross storage area required for open storage.

Site areas for each type of storage are based on gross storage areas. Factors for computations are found in paragraph 150.

Covered storage = 2.00

Open storage = 1.50

(Assume storage is to be in communications zone; hence additional combat zone factor of 5 is not required.)

$420,000 \text{ sq ft} \times 2.00 = 840,000 \text{ sq ft}$, site area required for covered storage.

$400,500 \text{ sq ft} \times 1.50 = 600,750 \text{ sq ft}$, site area required for open storage.

Total site area required:

Covered storage = 840,000 sq ft

Open storage = 600,750 sq ft

1,440,750 sq ft

1,440,750 sq ft ÷ 43,560 sq ft (1 acre) is 30.7 say *31 acres of site area required.*

c. Situation, Problem B. To determine operating personnel and materials handling equipment requirements for all storage in a theater which has a strength of 250,000 men.

d. Solution, Problem B.

- (1) *Part I, operating personnel requirements.* (See graph, par. 151.) On the horizontal scale of this graph, locate the vertical line representing 250,000 men. This line crosses the oblique graph line at the horizontal line representing *24,500 operating personnel* as indicated on the left margin. Therefore, for general planning purposes, 24,500 men are needed to operate theater depots.
- (2) *Part II, materials handling equipment requirements.* Using the same assumption for theater strength as used in part I above, the graph in paragraph 154 shows that for 250,000 men, *18,500 measurement tons of materials handling equipment* will be required.

156. Characteristics of Materials Handling Equipment

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	1	2	3	4	5	6	7	8	9	10	11
1	Item*	Dimensions			Weight (lb)		Dis- place- ment (cu ft)	Capacity		Method of operation	Primary use
		Length (in.)	Width (in.)	Height (in.) min- imum	Operat- ing	Ship- ping		Load (lb)	Height (ft)		
2	Trucks, fork lift.....	94	28	80	3,520	4,300	140	2,000	9	Gasoline.....	Useful in moving and stacking palletized loads. Not efficient to move supplies over horizontal distances greater than 250 ft.
3		97	33	83	3,880	4,480	146	2,000	9	Electric.....	
4		110	38	83	5,400	6,600	186	3,000	9	Gasoline.....	
5		100	34	83	5,350	6,500	150	3,000	9'5"	Electric.....	
6		143	42	83	10,700			6,000	14	Gasoline.....	
7		122	43	83	10,460	11,800	226	6,000	9'11"	Electric.....	
8		196	86	150	15,800	16,400		15,000	17'6"	Gasoline.....	
9		158	59	83	16,500	18,800	375	10,000	8'2"	Electric.....	Primarily for transporting unit loads short dis- tances. May be used for stacking. Less expen- sive than fork lift trucks, but less maneuverable.
10	Trucks, platform.....	128	41	83	4,810			4,000	8'6"	Gasoline.....	
11		82	34	48	1,150	2,000	118	3,000	0	Electric.....	
12		131	43	58	4,000	4,910	229	6,000	1'4.5"	Gasoline.....	
13		126	41	54	3,825			10,000	1'4"	Gasoline.....	
14		150	44	102	8,500	10,300	465	20,000	5'2"	Electric.....	
15		160	53	107	12,600	14,400	450	30,000	2'5"	Electric.....	
16								Draw bar pull (lb)			Used for drag towing on skids or towing one or more trailers. Tractor is small and maneuverable. Should be used for moving when distance exceeds 250 ft.
17	Tractors, warehouse.....	112	64	52	2,260	2,400	162		1,600	Gasoline.....	
18		92	42	52	2,750	3,850	174		2,200	Gasoline.....	
19		68	39	57	3,170	3,700	149		2,600	Gasoline.....	
20		117	69	76	4,660				3,300	Gasoline.....	
21		99	60	60	4,000				5,000	Gasoline.....	
22		130	89	72	10,900	13,200	480		7,500	Gasoline.....	
23		77	41	59	3,400	3,970	142		2,100	Electric.....	

24								Load (lbs)			
25	Cranes, wheeled, fixed boom---	135	60	186	12,300	13,400			6,000	Gasoline-----	Handles loads of sbapes and sizes which are moved with difficulty by other equipment.
26		150	66	204	16,500	2,000	730		10,000	Gasoline-----	
27		150	78	212	21,000	23,900			14,000	Gasoline-----	
28	Cranes, wheeled, slung-----	135	43	77½	5,200	6,450	310		2,000	Electric-----	
29		130	70	264	14,000				5,000	Electric-----	
30		130	62	231	15,000				10,000	Electric-----	
31	Trucks, straddle-----	157	93	372	34,500	39,000			20,000	Gasoline-----	Used extensively for moving lumber, poles, pipe, rods, and girders.
32		130	71	89	7,000				10,000	Gasoline-----	
33		147	78	126	9,000	13,200	910		14,000	Gasoline-----	
34		187	90	126	12,100	17,200	955		20,000	Gasoline-----	
35		187	104	140	13,500	19,200	1,130		30,000	Gasoline-----	

*All items of materials handling equipment not listed here. Typical items of varying capacities are listed. For more complete information, see TM 10-1619.

Section X. DISTRIBUTION

157. Routine Requisition and Shipping Times ¹

OVERSEA THEATERS TO ZONE OF INTERIOR

	<i>Days</i>
Consolidating inventories and preparation of requisition in theater.....	15
Air mail time to port of embarkation.....	5
Port of embarkation edits and extracts requisition.....	10
Mail time to depot in zone of interior.....	5
Depot processes requisition and sets up shipment.....	² 30
Transit time from depot to port of embarkation.....	10
Port of embarkation loads and ships.....	15
Transit time from port of embarkation to theater.....	20
Port of discharge unloads supplies.....	10

Total elapsed time from date requisition initiated until the supplies
are available for issue in theater of operations..... 120

¹ Days shown are for illustration purposes only and represent time intervals for processing routine bulk shipments of supplies. Such intervals will increase or decrease in proportion to the distance of the theater from the zone of interior, distances within the theater, and transportation and other handling facilities. Total elapsed time for emergency requisitions for supplies shipped by air may be as low as 5 days.

² Days shown assume that the supplies are carried in stock. Requisitions for supplies which require special procurement may increase this period 6 or 12 months.

158. Buildup of Supply Levels

a. For estimation of requirements where it is desired to build up a certain level of supplies by a given date, at the same time adequately supplying present and future contemplated operations during the buildup period, the following formula is useful:

$$S = C \left(1 + \frac{L}{T} + W \right)$$

where:

S equals *shipping requirements* during the buildup phase, expressed in pounds per day.

C equals *consumption* (average) in pounds per day.

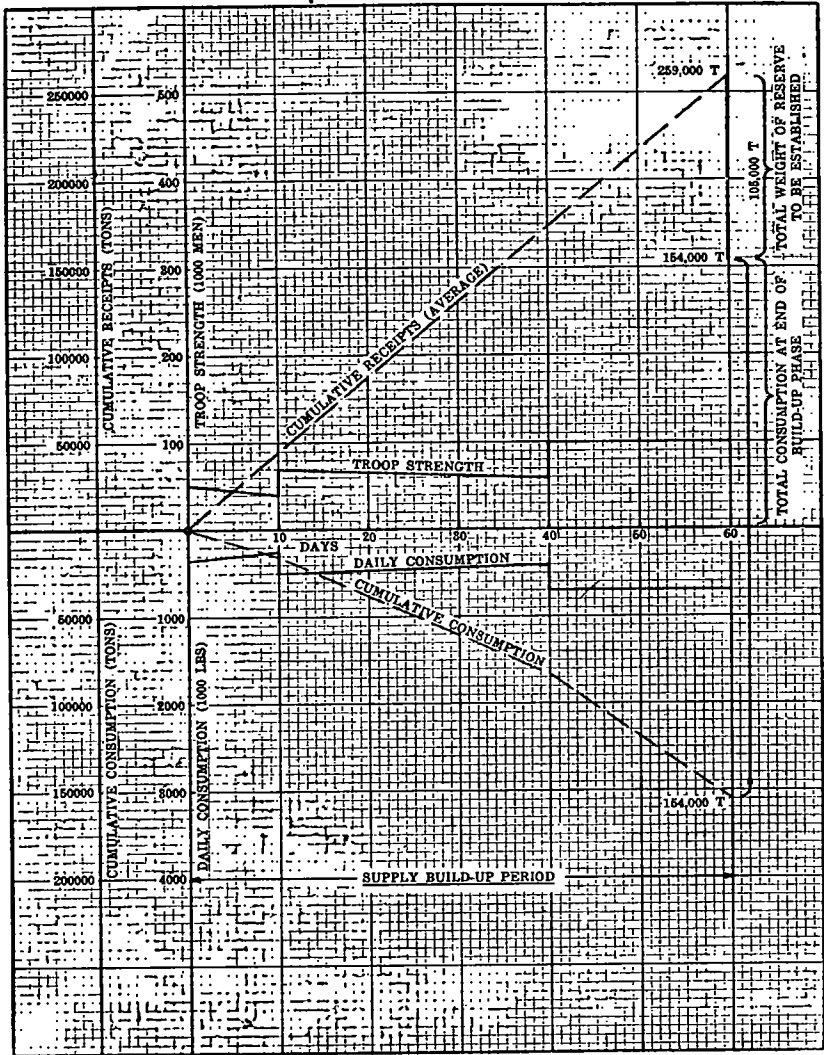
W equals a *wastage factor* (percentage of total consumption expressed as a decimal). This factor is based on experience in the particular theater and normally ranges from 0 to .25.

L equals the *supply level to be attained*, expressed in days of supply.

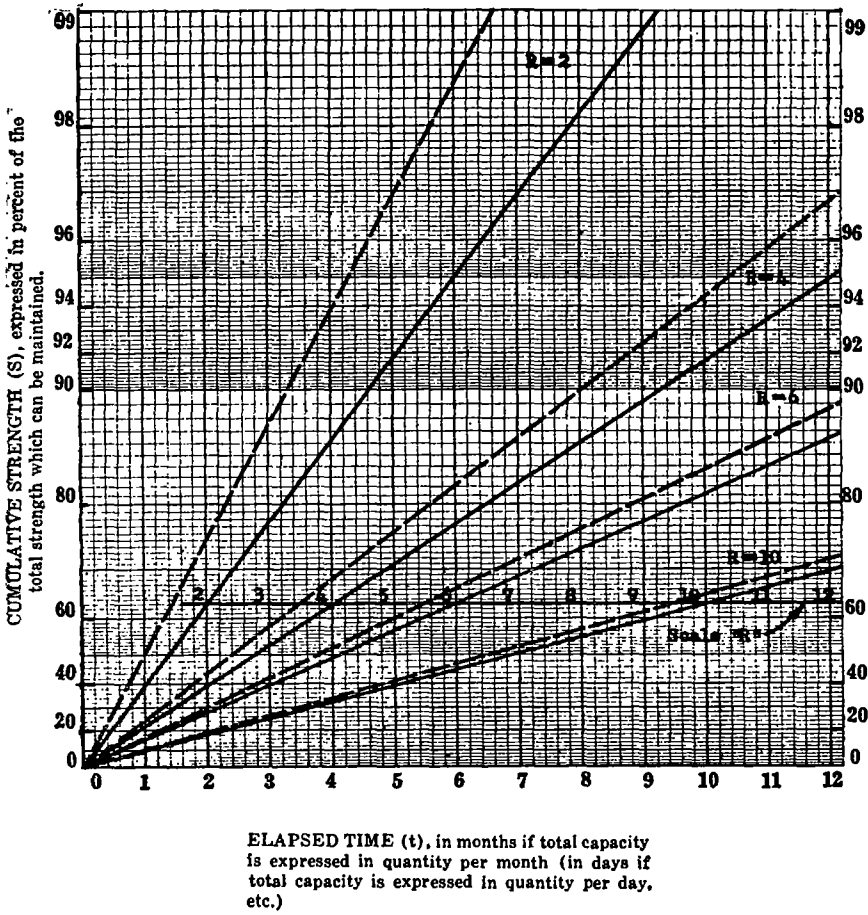
T equals *time length of build-up phase* in days.

(Given any four of the factors, the fifth can be determined by transposing.)

b. Since the formula in a above assumes a constant troop strength, a chart similar to the following may be used to show the relation between changes in troop strength, the cumulative consumption, and cumulative receipts in the establishment of a specified level of supply during a given buildup period.



159. Lines of Communication Buildup Capacity



a. General.

- (1) The preceding chart indicates the maximum cumulative strength which can be built up in the shortest time, using lines of communications of fixed capacity, if those lines of communications also carry replenishment loads for personnel previously transmitted.
- (2) The chart is applicable to situations in which maintenance loads are directly proportional to loads previously carried (initial loads) and has been prepared for the values 2, 4, 6, and 10 of R (ratio of initial to maintenance loads). Additional lines can be added readily to the chart for additional values of R .
- (3) For each value of R , there are shown two lines on the chart—one solid and one dashed. For each value of R , use of the solid or dashed line in computations depends upon the assumption applicable to the situation—
 - (a) The solid-line curve in each case is based on the assumption that at any time t , the strength being served on a maintenance basis, is equal to the accumulation of strength previously served on an initial basis (that is, maintenance begins immediately upon passage, and initial loads are not alternately depleted and replenished).
 - (b) The dashed-line curve in each case is based on the assumption that the increment of strength served on an initial basis in any one month will be served on a maintenance basis during the following month (that is, initial loads would be depleted, on the average, by approximately 15 days' maintenance supply before replenishment would begin).

b. Construction of Curves for Additional Values of R . To construct curves for values of R , other than those shown, proceed as follows:

- (1) For solid lines (see assumption above), draw a straight line through the origin (0,0) and the point on scale R representing the value of R (ratio initial/maintenance loads).
- (2) For dashed lines (see assumption above), draw a straight line through the origin (0,0) and the point on scale R which is less by 0.5 than the value of R .

c. Examples of Use of Chart. This chart may be used in calculations relating to the movement of troops or supplies through a port of embarkation or, analogously, to their movement over any available lines of communications—for example, a railroad, a highway, an air transport route. It can be used to determine the time it would take

to reach various strengths, the strength which can be accumulated in any amount of time, and the necessary ship loads of initial or maintenance supplies. The ratio R may be based on space requirements; number of cars, ships, tonnages; number of individuals; etc.

(1) *Example 1*

(a) *Problem.* The capacity of a port is 300,000 MT/month. Initial equipment for troops moving through the port = 4.8 MT/man: supplies for maintenance of troops moved through the port = 0.8 MT/man/month. What strength can be built up through this port in 7 months if maintenance supply for the troops begins immediately with their passage?

(b) *Solution.*

1. $R = \text{initial} \div \text{maintenance load} = 4.8 \div 0.8 = 6$.
2. $t = \text{time elapsed} = 7$ months.
3. From the chart, locate $t = 7$ on the horizontal scale, and continuing vertically upward to the intersection of $t = 7$ with the *solid* line for $R = 6$, read "Cumulative Strength (S)" from the vertical scale = 69 percent of the total strength which can be maintained.
4. Total strength which can be maintained = $300,000 / 0.8 = 375,000$ troops.
5. Therefore, cumulative strength after 7 months = 69 percent of 375,000 = 259,000 troops.

(2) *Example 2.*

(a) *Problem.* Assuming the same circumstances in example 1, above, how many new troops will be moved through the port during the seventh month?

(b) *Solution.*

1. Proceed as in the solution to example 1, above, except determine the cumulative strength after 6 months = 64 percent of the total strength which can be maintained.
2. From the solution to example 1 and the foregoing, it is observed that from the end of the sixth to the end of the seventh month (that is, during the seventh month), the cumulative strength changed from 64 percent to 69 percent of the total strength which could be maintained.
3. Therefore, the new troops moved in during the seventh month represent $69 \text{ less } 64 \text{ percent} = 5 \text{ percent}$ of the total strength which can be maintained = 5 percent of 375,000 = 18,750 troops.

(3) *Example 3.*

(a) *Problem.* Assuming the circumstances as in example 1, above, *except* that the maintenance factor of 0.8 MT/man/month is so established that maintenance can start during the following month for all troops moved initially during any one month, what could be the strength built up after 7 months?

(b) *Solution.*

1. Proceed as in the solution to example 1, above, except that in using the chart, use the *dashed* line for $R=6$ instead of the solid line.
2. Read cumulative strength=72 percent of the total strength which can be maintained.
3. Cumulative strength after 7 months=72 percent of 375,000=270,000 troops.

(4) *Example 4.*

(a) *Problem.* Initial and maintenance supplies for service forces are to be moved over a highway the capacity of which is 10,000 short tons per month. Initial equipment for these forces averages 3,350 pounds per man; maintenance averages 430 pounds per man per month. When will the size of the service force have been built up to 60 percent of its ultimate strength, if maintenance supply must begin immediately upon passage of the forces?

(b) *Solution.*

1. $S=60$ percent of the maximum which can be supported.
2. $R=3,350/430=7.8$
3. Inasmuch as no line for $R=7.8$ appears on the chart, it must be constructed. Observing the assumption in the problem above as to initiation of maintenance, draw a *solid* line through (0,0) and the point 7.8 on scale R (in accordance with directions above).
4. Using the constructed line, as indicated in previous examples, determine for $S=60$ percent that $t=7$ months.

160. Combat Zone Supply Installations

a. *General.*

- (1) Listed below are the army supply installations usually found within the combat zone, showing in detail the class of supply for which each technical service is responsible and the normal

supply installations for each class of supply. For each class of supply (col. 1), three things are shown—in column 2, the depots found in the army maintenance area; in column 3, the supply points required to support the corps; and in column 4, the normal procedure by which divisions or similar using units draw the specific class of supply.

- (2) The supply system within the army must be simple and, above all, flexible to meet changing situations. Keep in mind the mission, terrain, weather, road, and railnets in selecting locations for supply installations.
 - (a) On the offensive, one would expect the supply points to be well forward and contain at least 2 to 3 days of supply for the unit or units being served. As a general rule, one would expect to find at least a class I, a class III and a class V supply point supporting each corps, located well forward in the area but out of heavy artillery range. Engineer classes II and IV supply points might also be established if the conditions of roads and bridges require large quantities of construction materials. In addition to the medical depot, there normally will be two advance medical supply points each supporting forward evacuation hospitals and divisions.
 - (b) On the defensive, the engineer classes II and IV supply points should be located well forward, containing fortification materials. The other supply points should be located farther to the rear and normally would carry from 3 to 5 days' level for the troops supported.
- (3) Supply points serve all units in the area. (If army troops are located near a supply point, then that supply point will serve those units.) All army supply points are operated by army troops. All supply installations located in the corps or division area are cleared for area locations by corps or division before they are established.
- (4) These are general rules of thumb that can be used in establishing an efficient supply system to support an army. An army G4 and the technical service officers will have to be on the alert to meet changing situations—always planning ahead to have supplies available when needed.
- (5) This study shows the type of supply installations needed to support a field army under normal conditions. However, it must be realized that ground reconnaissance is the only method for selecting sites for installations.

1 Item	2 Army Maintenance Area	3 Corps Area	4 Unit Supply Procedure ¹
1 Chemical Classes II & IV	1. Installation: Chemical Classes II and IV depot. XXXX 301 (Dep) 2. Conventional sign 3. One such depot normally in army maintenance area. 4. Normally for retail issue, however, wholesale issue is made to supply points if necessary for establishment of supply points arises. 5. Operated by one or more chemical depot companies depending on size of army and on gas warfare or non-gas warfare conditions. 6. Levels established by theater. Will normally be 15 days.² 7. Covered storage required—approximately 80 percent. 8. Maintenance is furnished in or adjacent to this depot for chemical material by chemical maintenance companies.	1. Installation: Chemical Classes II and IV supply points. XXXX 303 (Sup Pt) 2. Conventional sign 3. When necessary. Normally under corps operated by chemical service battalion. 4. Normally retail issue. 5. Levels established by army 6. Covered storage required—approximately 80 percent. 7. Maintenance is furnished in or adjacent to this supply point by chemical maintenance company of service battalion.	1. Regiments and separate units will consolidate and submit requirements of subordinate elements to division chemical officer. 2. Division chemical officer can initiate requirements of division and submit requisition direct to army chemical officer or depot. If supplies are regulated requisitions are normally submitted through command channels, or to army chemical officer for approval based on army or corps commanders' priorities.³ 3. Upon notification by army that supplies are ready, division chemical officer arranges with division (4-4 for transportation to pick up the supplies and to deliver them to division trains area where supplies are broken down by division chemical officer. 4. Division units, upon notification by division chemical officer will pick up supplies from division trains area. 5. Corps troops submit requirements to corps chemical officer who then assembles the requirements and requisitions on army chemical depot. 6. When supplies are ready for issue, corps troops will normally draw directly from army chemical depot.
2 Chemical Class V	1. Installation: Chemical Class V depot. XXXX 302 (Dep) 2. Conventional sign: 3. One such depot normally established as part of ordnance Class V depot, with the ordnance Class V conventional sign. Depending on the army commander's desire it may be located in army maintenance area in close proximity to the ordnance Class V depot. 4. Wholesale issue to Class V supply points; retail to army troops. 5. Operated by one or more chemical depot companies depending on size of army and on gas or non-gas warfare conditions. 6. Levels established by theater. Normally 15 days of operation.² 7. Covered storage required—negligible. 8. When required, army allocates Class V supplies to corps. Copy of allocation to supply point. 9. Mixed flame thrower fuel is normally carried in Class V depot. (Where units do their own mixing, they draw gasoline from Class III supply point serving them and draw Napalm from chemical Class V depot.)	1. Installation: Chemical Class V supply point. XXXX 304 (Sup Pt) 2. Conventional sign: 3. Normally a part of or included in ordnance Class V supply point. One or more of these supply points may be established in corps area depending on needs of using troops located in close proximity of the ordnance Class V supply point. Depending on the army commander's desire it may be established as part of the ordnance Class V supply point, with the ordnance Class V conventional sign. 4. Retail issue to corps and divisions. 5. Operated by section or platoon of chemical depot company. 6. Levels established by army; usually 2 to 3 days of operation. 7. When required, corps allocates Class V chemical supplies to divisions and corps troops. 8. Supply point receives copies of army and corps allocations. 9. See note 9 in column 2.	1. Regiments and separate units will draw ammunition from the army Class V supply point supporting corps, based upon transportation order approved by division ammunition officer. Normally the quantity requested is to replace the basic load. 2. Corps troops accomplish their own transportation order, or equivalent, and draw requirements directly from Class V supply point in corps area. 3. Corps controls the issue of Class V chemical supplies to corps troops, if necessary. 4. Division, if necessary, controls the issue to subordinate units. 5. All ammunition issues to divisions are coordinated through division ammunition officer. 6. Division units will draw ammunition directly from army supply point.
3 Engineer Classes II & IV	1. Installation: Engineer Classes II and IV depot. XXXX 501 (Dep) 2. Conventional sign 3. Normally one per army located in army maintenance area. 4. Operated by engineer depot company (TO&E 5-267A). 5. Level—15 days (5,000–20,000 tons).² Large quantities of construction materials, lumber, steel, and road material, may be procured locally and not pass through the depot system. 6. Class II—issued on replacement or exchange basis on receipt of requisition approved by engineer supply officer of divisions and corps troops. Requests in excess of allowances require corps and army engineer approval. 7. Class IV—issued on request of unit engineer supply officer. 8. Regulated items—see note 5. 9. Maintenance companies maintain all stocks of fast moving items and issue first and second echelon parts to units. Replenishment is from army engineer depots.	1. Installation: Engineer Classes II and IV supply points. XXXX 501 (Sup Pt) 2. Conventional sign 3. Normally one per corps. Operated by Engineer Supply Point Company (TO&E 5-48). 4. Level—3 days (250–400 tons). Stockage generally consists of fortification or bridge materials. Corps bridge units may carry additional stocks of bridging materials. 5. Maintenance companies maintain small stocks of fast moving items and issue first and second echelon parts to units. Replenishment is from army engineer depot. 6. Army stocks these supply points based on daily withdrawals and expected operations.	1. A division engineer dump carrying limited quantities of selected items may be operated by the division engineer battalion. It is located either at the headquarters and headquarters company of the engineer battalion or is consolidated with other divisional services near the rear echelon. In any case, fortification and camouflage materials may be left in the infantry regimental areas, when desired. This latter method is more normal. 2. Class II—units requisition through division engineer. 3. Class IV—units request informally through division engineer. 4. Regulated items require approval of army engineer before items can be drawn from army depot or supply points based on army or corps commander's priorities.³ 5. Supplies are brought to the division area by division engineer using division engineer or division transportation. 6. Spare parts may be obtained through depot system or through supporting engineer maintenance company.



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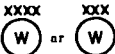
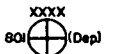
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1 Item	2 Army Maintenance Area	3 Corps Area	4 Unit Supply Procedure ¹
4 Engineer Water	1. Conventional sign:  2. Normally one per army. 3. Production: 540,000 gal—1 day. 4. Distribution: 14,400 gal tank load. 5. Storage capacity 108,000 gal. 6. Used to supplement water sources of army, corps, and division engineers, to transport water to units without a sufficient local source; and to transport water to installations which use large quantities of water and have inadequate means to transport it.	1. Installation: Engineer water point. 2. Conventional sign:  3. One to four points may be established by each corps and army engineer battalion. 4. Maximum production, each battalion—168,000 gal. 5. Maximum storage, each battalion—36,000 gal. 6. Issue is made to all consumers who arrive at water point with empty containers. 7. Amphibious or airborne operations—water points of organic units can be in operation on D-day, four hours after arriving at source. Five days of supply often taken ashore in 5-gal drums and 55-gal drums and issued with Class I supplies.	1. Installation: Division water point. 2. Conventional sign:  3. One to four points may be established by the division engineer battalion. 4. Production and storage capacity same as for corps engineer battalion. 5. Issue is made to unit kitchen trucks and water trailers which are sent to water points and transport water to unit kitchens.
5 Engineer Maps	1. Installation: Engineer map depot.  2. Conventional sign: 3. Normally one in army maintenance area located near Army headquarters. 4. Operated by map reproduction and distribution company. 5. Issues made to army troops, corps, and divisions on basis of Army Table of Map Allowances. 6. Normally one engineer topographic battalion performs new mapping, photomapping, reproduction, survey methods. Lithography and contact prints—size 22" x 29". 7. Maps are obtained from army topographic battalion and base map depots in communications zone.	1. Corps may operate map depot to supply division and corps troops. 2. Issues made to corps troops and divisions on basis of Army Table of Map Allowances. 3. Maps obtained from corps topographic company and army topographic Bn.	1. Division troops receive maps from division engineer battalion which distributes maps under the staff supervision of division G-2. 2. Division engineer obtains maps from the corps engineer. 3. Division usually requires one strategic map, one road map, and two tactical maps.
6 Medical Classes II & IV	1. Installation: Medical Classes II & IV depot.  2. Conventional sign: 3. Normally one per army located in army maintenance area. 4. Operated by medical depot company (TO&E 8-67). 5. Army level—15 days.² 6. Depot restocks advance supply points and makes retail issues to units located in army service area. 7. Regulated items require approval of the army surgeon based on army commander's priorities.³ 8. Ninety percent of supplies require covered storage.	1. Installation: Medical Classes II & IV supply point.  2. Conventional sign: 3. Located within easy reach of evacuation hospitals. 4. Normally there will be two advance supply points (supporting all corps) with the primary mission of making bulk issues to division and retail issues to other units and hospitals. 5. Operated by section of a medical depot company. 6. Issues are made in accordance with authorized allowances or allocations. 7. Supply points are restocked by sending transportation to the medical depot. 8. Level—2 to 3 days.	1. Division medical battalion consolidates the requirements of the units of the division and draws in bulk from the nearest medical supply point. 2. Medical battalion draws supplies and hauls to the division area where supplies are broken down and issued to units. 3. Army medical units draw direct from nearest medical supply point.
7 Medical Laboratory	1. Installation: Medical laboratory.  2. Conventional sign: 3. Located in army maintenance area. 4. Carries a stock of laboratory supplies for army medical units.		Army medical units draw laboratory supplies from army medical laboratory located in army maintenance area.
8 Ordnance Classes II & IV	1. Installation: Ordnance Classes II and IV depot.  2. Conventional sign: 3. a. Normally of two types, wholesale and retail. There is one wholesale depot located in the army maintenance area. It is operated by the army depot battalion consisting of approximately four depot companies. It issues only to depot companies operating retail depots and to the army field shop. Located in center of maintenance area to support depot companies. Normal level—15 days for the army.	1. Nondivisional units are supplied by ordnance maintenance companies supporting them. All ordnance maintenance companies are army ordnance units. 2. Nonregulated items issued on requisition or direct exchange of serviceable items for unserviceable items. 3. Regulated items issued on allocations by corps or army.⁵ 4. Using unit need have contact with one ordnance unit only in dealing on all supply or maintenance matters. 5. Supply level—15 days for units supported plus sufficient supplies for own shop activities.	1. Regiments consolidate requirements for companies and submit to division ordnance unit; separate companies or battalions consolidate requirements and submit to division ordnance unit. 2. Division ordnance unit consolidates ordnance Class II and IV requirements for division and attached units and draws from army ordnance retail depot. 3. Division ordnance unit hauls from retail depot to division ordnance bivouac where supplies are broken down and issued to major units. 4. Major items may be delivered to division ordnance unit by army ordnance unit.

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1 Item	2 Army Maintenance Area	3 Corps Area	4 Unit Supply Procedure ¹
8 Ordnance Classes II & IV (continued)	b. Retail depots issue to ordnance maintenance units only, including division ordnance units. One in each forward heavy support battalion and one in the army service heavy support battalion. Operated by Ordnance Depot Co (Army), TO&E 9-57. Normal supply level is 15 days of selected items for units supported. 4. Vehicles, trailers, and artillery weapons are received, stored, and distributed by an ordnance vehicle and artillery park company. Distribution is through maintenance channels. Located in rear of army maintenance area, and if possible near a railhead.		
9 Ordnance Class V	1. Installation: Ordnance Class V depot. XXXX 910  (Dep) 2. Conventional sign 3. At least one ammunition depot located in the army maintenance area. 4. Operated by ordnance ammunition battalion 5. Receives Class V supplies from communications zone. Maintains principal reserve and distributes to ammunition supply points as directed by army ordnance officer 6. May store and issue chemical Class V. 7. Normal level established by theater—15 days operation.² 8. This depot should be located as far forward in the maintenance area as possible due to heavy tonnages it must handle; if possible rail into or in close proximity to the depot.	1. Installation: Ordnance Class V supply point (ASP). XXXX 911  (ASP) 2. Conventional sign 3. At least one per corps. Number may be increased as required to fulfill responsibility of army to place adequate supplies within easy reach of combat units. 4. Operated by army ordnance. One or more ammunition companies required, depending upon quantity of supplies handled. 5. When necessary, army controls the issue of Class V to corps and corps, in turn, controls the issue to divisions and corps troops. 6. When such controls of Class V are necessary, army and corps send information copies of these controls to the ammunition supply point from which ammunition will be drawn. 7. Units draw direct from supply points based on transportation order and haul with unit transportation. 8. Level—for 3 to 5 days operation. 9. May store and issue chemical Class V. 10. Supply points are stocked daily by army based on the days issue.	1. Regiments and separate battalions consolidate requests from companies or batteries and submit to division ammunition officer. 2. Requests are approved by the division ammunition officer (DAO). After approval by the DAO, requests become transportation orders. 3. Requests are not consolidated by the DAO. 4. Requests are normally the quantity required to replenish basic load.
10 Quartermaster Class I	1. Installation: Class I depot. XXXX 601  (Dep) 2. Conventional sign 3. At least one located in army maintenance area. Located well forward in maintenance area. 4. Operated by one QM Subsistence Depot company and five service companies. 5. Can handle supplies for force 325,000 to 100,000 troops. 6. Unless items such as flour, sugar, etc. are in waterproof containers—limited covered storage is desired. 7. Levels are established by theater. Normally Class I level for army is 10 days based on army's consumption rate.² 8. Supply point for Class I located near depot to serve army troops or a portion of the depot set aside for retail issue to army troops.	1. Installation: Class I supply point. XXXX 651  (Sup Pt) 2. Conventional sign: 3. At least one per corps.¹ 4. Located as far forward in corps area as possible, depending on type of operation. Should be out of heavy artillery range; on a good road net; centrally located to support all units of the corps; as much concealment as possible, army must secure corps clearance for area location. 5. Can supply corps 60,000 to 100,000. 6. Operated by one Subsistence Supply Co when handling Class I only. 7. Supply point may also be located in army area to serve army troops. 8. Levels for army supply points are established by army. Normally 2 to 3 days for units the supply point supports.	1. Regiments consolidate requirements for companies and submit consolidated requirements to division quartermaster; separate battalions consolidate for their units and submit requirements to division quartermaster; attached units submit their requirements to division quartermaster. 2. Division quartermaster consolidates Class I requirements for division and attached units and draws direct from Class I supply point based on daily ration request normally submitted 24 to 48 hours previous to time of drawing rations 3. Division hauls from army supply point to division distributing point where rations are broken down for major units, such as regiments, separate battalions and separate companies. 4. Normally units come back to distributing point for their supplies (supply point distribution) Division quartermaster may haul to major units (unit distribution).
11 Quartermaster Class III	1. Installation: Class III depot. XXXX 620  (Dep) 2. Conventional sign 3. At least one located in army maintenance area. Depending on method of delivery from communications zone, facilities must be available for decanting at end of pipe line area to receive bulk in tank cars or trailers to decant from bulk to 5-gallon drums, and a storage area for 5-gallon drums or 55-gallon drums. Should be located well forward in maintenance area.	1. Installation: Class III supply point. XXXX 621  (Sup Pt) 2. Conventional sign: 3. At least one per corps.¹ 4. Location—same as for Class I. 5. Can supply corps—60,000 to 100,000 troops. 6. Operated by petroleum supply company. 7. Supply points are stocked daily by army transportation based on the days issue report. 8. Levels for army supply points are established by Army. Normally 2 to 3 days for units the supply point supports.	1. Regiments consolidate requirements for companies and send empty drums to division Class III dump and exchange empty drums for filled ones. 2. Separate battalions and attached units send empty drums to division Class III dump and exchange empty drums for filled ones. 3. Division draws from army Class III supply point based on status report and articulated requirements. Where the situation is fluid division can make arrangements and allow for subordinate units to draw direct from army supply points.

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1 Item	2 Army Maintenance Area	3 Corps Area	4 Unit Supply Procedure ¹
11 Quartermaster Class III (continued)	4. Operated by one petroleum depot company and one to three service companies as required. 5. Can handle Class III supplies for force 325,000 to 400,000 troops. 6. Levels are established by theater. Normally Class III level for army is 10 days, based on army's consumption rate. ² 7. Supply point for Class III located near depot to serve army troops or a portion of the depot set aside for retail issue to army troops.		4. Armored divisions may prescribe the same procedure as outlined in 1, 2, and 3 above or may prescribe that separate battalions independently under combat command control go direct to army Class III supply point and exchange empty drums for full drums. (Armored division quartermaster at times establishes a mobile Class III dump). 5. Normally, any vehicle going to the rear and passing by a Class III supply point refills with gasoline before returning to the forward area.
12 Quartermaster Class II & IV	1. Installation: Quartermaster Classes II and IV depot. XXXX 600 (Dep)  2. Conventional sign: 3. Normally not more than one located in army maintenance area. Warehouses in cities and towns make the best depot. 4. Operated by one clothing and general supply depot company and two service companies. 5. Can handle Classes II and IV supplies for force 325,000 to 400,000 troops. 6. Covered storage required—90 percent. 7. Levels are established by theater. Normally, Classes II and IV level 15 days based on army's maintenance factors. ² 8. Army commander allocates regulated items to subordinate units. ³	1. Corps units follow same procedure as for division troops except that requisitions are consolidated by battalion and submitted to army quartermaster Classes II and IV depot. 2. Corps allocates regulated items to corps troops and divisions. Requisitions for regulated items must be approved by army quartermaster based on army commander's policies. ⁴	1. Regiments consolidate requirements for Classes II and IV for companies and submit consolidated requisitions to division quartermaster. 2. Division quartermaster consolidates or assembles the requirements for the division to include attached units and submits same to quartermaster Classes II and IV depot except for regulated items which are submitted to army quartermaster. ⁵ 3. The division, assigned a day of the week to pick up supplies requisitioned does so by sending division quartermaster transportation to army Classes II and IV depot or makes arrangements for units to pick up their supplies. ⁴ 4. In emergency requisitions for quartermaster Classes II and IV can be submitted direct to army Classes II and IV depot by division quartermaster and picked up the same day. 5. Where conditions are not satisfactory for division to send transportation to army depot, army quartermaster can arrange to send Classes II and IV supplies to Class I supply point for designated unit.
13 Signal Classes II & IV	1. Installation: Signal Classes II and IV depot. XXXX 701 (Dep)  2. Conventional sign 3. At least one located in maintenance area. 4. Operated by signal depot company (TO&E 11-128). 5. Can handle Classes II and IV supplies for army. 6. Covered storage required for 75-90 percent of tonnage. 7. Army units draw from signal depot based on army signal officer's approval. 8. Army level—15 days. 9. Regulated items require approval army signal officer based on army commander's policies. ³	1. Normally army establishes a main signal depot and operates up to three (3) forward signal supply points. 2. The corps signal battalion maintains a small stock of fast moving items that can be issued to corps troops. Normally corps units follow same procedure as for divisions except that requisitions are submitted to corps signal officer who consolidates the requisitions and submits same to army signal depot. 3. Based on army's allocation of regulated items to corps, corps allocates regulated items to corps troops and divisions. Requisitions for regulated items must be approved by the army signal officer based on the army commander's policies or priorities of issue. ¹	1. Within regiments, requisitions are consolidated through the chain of command, and regiment submits their requirements to division signal officer; separate and attached companies and battalions consolidate their requirements and submit requisitions to division signal officer. 2. Division signal officer consolidates or assembles the requirements for the division and attached units and submits same direct to army signal depot. Regulated items require approval (army signal officer) based on army and corps commander's priorities of issue. ³ 3. Division signal supply section picks up supplies at army signal depot or forward signal dump or makes arrangements for units to do so whenever need makes it expedient. 4. Units of the division normally pick up supplies at the division signal dump when notified such supplies have been procured. Some wire and the more common batteries are kept on hand and are available within reason, by coming for them. 5. All signal units are authorized a prescribed load of wire and fast moving items, such as, common batteries and radio tubes.
14 Transportation	Normally transportation has no supplies in army area. Transportation Corps items such as life preservers are stored in engineer Classes II and IV depot.		

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b. Installations.

¹ The phrase "consolidate supply requirements" means for the unit to consolidate into *one requisition* the requirements for its subordinate and attached units.

The phrase "assemble supply requirements," means for the unit to collect and edit the supply requirements for its subordinate and attached units and forward these requirements as *separate requisitions for each subordinate unit*.

Normal procedure is for divisions to include supply requirements for units attached to the division. This procedure is followed except when the unit is attached for a short period of time.

² General levels established by theater which are considered a part of theater stocks do not include levels in supply points, except for class V supplies.

³ Nature of terrain and lines of communications sometimes require additional supply points to support one corps.

⁴ Normally, units of the division will come to quartermaster trains area to pick up their classes II and IV requirements.

⁵ Regulated items—requisitioned through command channels, however, may be issued against approved command allocations or priorities subject to approval of chief of technical service at appropriate echelon—latter authority may be delegated to depot commanders.

CHAPTER 6

LOGISTICS—EVACUATION AND HOSPITALIZATION

Section I. ESTIMATE OF PATIENTS

161. Classification of Patients

a. The term *patient* includes all military personnel excused from duty because of illness, nonbattle injury, battle wound, or injury. For most purposes discussed in this chapter only those patients who require hospitalization or who are excused from the performance of military duty and not returned to duty within the calendar day of admission to a medical treatment facility need be considered. Patients may be classified in several ways depending upon the purpose for which such classification is made. It is important to note that not all casualties or nonbattle losses are patients.

b. In making estimates of patients or in computing hospital bed requirements, patients are usually classified by cause of disability into disease patients, nonbattle injury patients, and battle wound or injury patients. The latter group falls in the category of casualties.

c. Patients may be classified as hospital patients, quarters patients, or similar classification depending upon the type of medical treatment facility under consideration.

d. In calculating evacuation requirements, patients may be classified by—

- (1) Severity of disability, into *walking* and *litter* patients.
- (2) Suitability for evacuation, into *transportable* and *nontransportable* patients.
- (3) Type of accommodation required for evacuation, into *recumbent* and *sitting* patients.

162. Admission Rate

The force of morbidity is usually expressed in the military services in terms of the number of admissions to medical treatment facilities (for example, to hospital, to hospital and quarters combined, etc.) per 1,000 average strength per year. The admission rate may be for all causes, for all diseases, for all nonbattle injuries or for all battle wounds or injuries. The admission rate may also be computed for

specific diseases or types of injuries. For purposes of logistical estimate for planning for hospitalization requirements, the admission rate is most conveniently expressed as a *daily admission rate to hospital per 1,000 average strength*.

Year	Daily Admission Rate to Hospitals Per 1,000 Strength—All Causes*			
	Total Army	ETO	SWP	POA
1943-----	1.9	1.1	2.4	1.7
1944-----	1.5	1.4	2.0	1.2
1945-----	1.3	1.2	2.0	1.0

*In using experience factors from theaters of operation it must be borne in mind that battle injury and wound rates are not primarily related to geography. In utilizing such rates for planning purposes it is necessary to consider the theater from the standpoint of type of combat, size and organization of forces, weapons employment, etc.

163. Disease and Nonbattle Injury

a. Diseases and nonbattle injuries among frontline troops of a seasoned command in campaign, except in a particularly unhealthful region, may be expected to produce a daily admission rate to medical treatment facilities (hospital and quarters combined) of about three per 1,000 per day (0.3 percent per day). This *average* rate can be expected at certain seasons of the year, without epidemics, to reach 0.5 percent or even more. As a rough rule of thumb *one-third* of these patients may be expected to remain under treatment in their own organization (at aid stations or collecting stations) or in the division clearing stations *if there is no interference with the primary mission of reception, treatment, and evacuation of casualties*. About two-thirds of the disease and nonbattle cases may be evacuated from the division area. Thus one-third of the patients are quarters cases and two-thirds of the patients are *hospital* cases.

b. The daily admission rate to hospitals, from disease and nonbattle injuries, may be shown as follows:

Year	Daily Admission Rate to Hospitals Per 1,000 Strength—Disease and Nonbattle Injury			
	Total Army	ETO	MTO	SWP
1942-----	1.4	----	----	2.3
1943-----	1.6	1.1	1.7	2.3
1944-----	1.4	1.0	1.9	1.9

This daily admission rate to *hospital* would correspond to an admission rate to *hospital and quarters* of about 0.3 percent and *soon* would result in a constant noneffective rate of about 4.5 percent. For unseasoned troops in the same climatic conditions, the noneffective rate might reach 6 percent and would be even higher under unfavorable conditions of climate and location.

c. On the basis of experience in the Mediterranean Theater of Operations during World War II, for *nonbattle sick and injured* it may be

expected that about 0.2 percent will die, 4 percent will be evacuated to the zone of interior, and the remainder, 95.8 percent, eventually will return to duty. The average stay in hospitals in a theater for nonbattle cases admitted to hospitals overseas during World War II was about 19 days, while the total average hospitalization, including time spent in zone of interior hospitals, was about 25 days.

d. For planning purposes, certain additional estimated daily *hospital* admission rates from *disease and nonbattle injuries* in oversea commands during recent years are as follows:

Estimated Disease and Nonbattle Injury Hospital Admission Rate (Admissions Per 1,000 Average Strength Per Day)

<i>Major oversea command</i>	<i>Daily rate per 1,000</i>
Alaska	0.9
Austria	.8
Caribbean	1.0
Europe	1.0
Far East	1.2
Pacific	.9
Trieste	1.1

The rates shown above have been prepared to provide current data for future planning. The data have been based on Army experience over the two fiscal years from July 1950 through June 1952. It should be borne in mind, however, that these rates reflect an experience unlike that of World War II. During World War II, U. S. Army troops were engaged in combat in several major oversea areas. In the experience on which the above rates have been based, all areas were free from the effect of combat with the exception of the Far East. Because of such limitations, care should be exercised in the use and interpretation of the data shown above.

164. Casualties

a. In estimating battle injuries and wounds, many variable factors must be considered. These include type of troops, their location in the theater, type of engagement, enemy capabilities, etc. For this reason, it is desirable in such estimations to separate all troops in a theater into groups having approximately the same casualty rate and compute the patients separately for each group on the basis of their numerical strength. For example, in a given theater the troops might be grouped into frontline divisions, other ground troops in the combat zone, Air Force troops, and troops in the communications zone. Each of these groups would have a different battle injury and wound rate, and the total patients in the theater would depend upon the relative strength of each group.

b. The average daily admission rates for casualties in various theaters during World War II were as follows:

Year	Daily Admission Rate to Hospitals per 1,000 Strength—Battle Injury and Wound		
	ETO	MTO	SWP
1943.....	---	0. 18	0. 03
1944.....	¹ 0. 66	0. 30	0. 09
1945 ²	0. 47	0. 18	0. 33

¹ June through December.

² January through April.

c. In estimating battle injury and wound patients in an army, an estimate based on frontline divisions engaged usually will be more accurate than one based on a rate for corps or the army as a whole.

d. Considerable variation in battle injury and wound admission rates among Air Force troops occurs, depending upon the type of aircraft, type of mission flown, and amount of enemy air resistance. As an overall average which necessarily must be modified to apply to any special situation, battle injury and wound admission rate for all air troops can be taken as 0.2 per 1,000 per day. More commonly, casualties in Air Force troops are computed on the basis of the number of man-missions flown.

e. The number of battle injuries and wounds among communications zone troops, except in special situations, is negligible.

f. The ratio of killed and wounded among casualties can be estimated as follows (the figs. do not include prisoners or persons missing in action).

Ratio of Killed to Wounded—World War II

Infantry:

European Theater of Operations.....	1:4
Mediterranean Theater of Operations.....	1:4
US Army Forces in Pacific.....	1:4
All theaters combined.....	1:4
Total Air Forces, all theaters.....	5:4
Armored, all theaters.....	2:7
Artillery, all theaters.....	1:4

- (1) In temperate and tropic zones, the overall ratio of killed to wounded may be taken as 1:4.
- (2) In the arctic zones, the ratio of killed to wounded may be considerably higher because of death of the wounded from exposure to cold.
- (3) On the basis of experience in World War II, it may be expected that about 4 percent of the wounded who reach hospitals will die; about 25 percent will be invalided home, and the remaining 71 percent will be returned to duty in the theater. Of those evacuated to the zone of interior, about 45 percent will return to duty. The average stay of

- wounded personnel in oversea and zone of interior hospitals in World War II was about 94 days.
- (4) Of the wounded who reached hospitals in World War II, about 4 percent died and about—
- 15 percent recovered in 15 days.
 - 19 percent recovered in 15 to 30 days.
 - 17 percent recovered in 30 to 60 days.
 - 11 percent recovered in 60 to 90 days.
 - 20 percent recovered after 90 days.
 - 14 percent were separated from the Army.
- (5) In World War I, it was found that of the gas casualties who reached hospitals, approximately—
- 2 percent died.
 - 25 percent recovered in 15 days.
 - 27 percent recovered in 15 to 30 days.
 - 24 percent recovered in 30 to 60 days.
 - 16 percent recovered after 60 days.
 - 6 percent were of no further military value.
- (6) The average stay of gas casualties in oversea and zone of interior hospitals was 41.8 days.

165. Statistics

The following tables represent statistics from World War II. To be used as staff planning factors, they may require modifications, depending upon the conditions anticipated.

a. Average Daily Admission Rate Per 1,000 From All Causes.

Combat conditions	Inf Div	Armd Div	Abn Div	Combat Zone	Com Z
Heavy	8	7	11	5	1.5
Average	4	4	4	3	1.5
Light	2	2	2	2	1.5

b. Average Daily Admission Rate Per 1,000 Air Force Troops.

Location	Disease and nonbattle injury	Battle injury and wound	Total
Pacific areas ¹	2.01	0.02	2.03
European areas ²	1.87	0.27	2.14
Average active combat	1.80	0.20	2.00

¹ Includes Far East Air Forces, Twentieth Air Force, and China and Burma-India Air Forces.

² Includes Air Forces in European and Mediterranean Theaters of Operation.

Section II. BED REQUIREMENTS

166. General

The hospital requirements of a theater of operations are computed in terms of total beds in hospitals capable of performing all types of treatment, not in terms of medical units. The total authorization to meet these requirements is expressed as the fixed bed allotment of the theater of operations. Medical units of the combat zone and convalescent centers of the communications zone are not included in the computation. Field hospitals are included in this allotment only when they are performing their primary mission. In general, the fixed hospital bed requirements of a theater of operations are satisfied by the assignment to the communications zone of appropriate numbers of general hospitals and station hospitals.

167. Basic Data

To compute bed requirements for any specific situation, certain basic data are necessary. These are the evacuation policy, daily admission rates, troop strengths, accumulation factor, and dispersion factor.

a. *Evacuation Policy.* *Theater evacuation policy* is a command decision made by the Department of the Army (usually upon the recommendation of the theater commander concerned). It specifies which patients will be evacuated to the zone of interior by designating a maximum number of days for the allowable period of hospitalization within the theater. Patients who, in the opinion of responsible medical officers, cannot be returned to a duty status within the period prescribed, are to be returned to the zone of interior by the first available and suitable transportation, provided the travel required will not aggravate their disabilities. The periods considered may be 30, 60, 90, 120, or 180 days. A minimum of 120 days is regarded as desirable in order to arrive at an optimal balance between trained men retained in the theater and the medical means required to care for them.

- (1) *Evacuation policies within a theater* may be established for certain areas and for certain types of medical installations, specifying which patients will be evacuated to the next higher echelon of medical care. For example, the theater commander may establish a 30-day evacuation policy for station hospitals. This would mean that all patients admitted to station hospitals whose recovery is likely to require more than 30 days would be evacuated to general hospitals. This would in no way affect the total fixed-bed requirements of the theater.

- (2) Certain flexible evacuation policies, useful as guides but varying with manpower policies, admission rates, and available beds, may be established for the combat zone. Similarly, evacuation policies for dispensaries may be specified.

b. Daily Admission Rates. See paragraph 162.

c. Accumulation Factor. Under a given evacuation policy, patients will accumulate in hospitals at a certain determinable rate, depending upon the admission rate, the type of disability, and the average period of hospitalization. Based upon experience in both world wars, these accumulation rates have been assembled into tables called *accumulation tables*. The accumulation factors given in such tables are based upon a daily admission rate of 1 per 1,000 strength and upon a specified evacuation policy. The tables below are for evacuation policies of 120, 90, 60, and 30 days. These accumulation factors take into account not only admissions to the hospital but also the various dispositions of patients from the hospitals.

(1) *Accumulation factors—120-day evacuation policy.*

	1	2	3	4	5	6	7
1	No. of days after hospitalization begins	Accumulation of patients per 1,000 strength based on admission rates of 1 per 1,000 a day each for disease and nonbattle injuries and for battle injuries and wounds and an evacuation policy of 120 days.					
		Disease and nonbattle injuries			Battle injuries and wounds		
		Total	T of Opns	ZI evacuees	Total	T of Opns	ZI evacuees
2	1.....	1.00	1.00	0	1.00	1.00	0
3	5.....	4.56	4.56	0	4.81	4.81	0
4	10.....	7.04	7.04	0	9.13	9.13	0
5	20.....	11.40	11.38	.02	16.87	16.71	.16
6	30.....	13.55	13.47	.08	23.66	23.14	.52
7	60.....	17.20	16.60	.60	40.05	36.63	3.42
8	90.....	19.45	18.38	1.07	52.19	43.53	8.66
9	120.....	20.98	19.48	1.50	61.40	46.75	14.65
10	150.....	21.97	19.48	2.49	68.42	46.75	21.67
11	180.....	22.59	19.48	3.11	73.95	46.75	27.20
12	240.....	23.21	19.48	3.73	82.18	46.75	35.43
13	300.....	23.46	19.48	3.98	87.82	46.75	41.07
14	360.....	23.56	19.48	4.08	90.80	46.75	44.05
15	Over 360.....	23.65	19.48	4.17	94.22	46.75	47.47

(2) *Accumulation factors—90-day evacuation policy.*

		2	3	4	5	6	7
1	No. of days after hospitalization begins	Accumulation of patients per 1,000 strength based on admission rates of 1 per 1,000 a day each for disease and nonbattle injuries and for battle injuries and wounds and an evacuation policy of 90 days.					
		Disease and nonbattle injuries			Battle injuries and wounds		
		Total	T of Opns	ZI evacuees	Total	T of Opns	ZI evacuees
2	1.....	1.00	1.00	0	1.00	1.00	0
3	5.....	4.56	4.56	0	4.81	4.81	0
4	10.....	7.64	7.64	0	9.13	9.13	0
5	20.....	11.40	11.38	.02	16.87	16.71	.16
6	30.....	13.55	13.47	.08	23.66	23.14	.52
7	60.....	17.20	16.60	.60	40.05	36.63	3.42
8	90.....	19.45	18.38	1.07	52.19	43.53	8.66
9	120.....	20.98	18.38	2.60	61.40	43.53	17.87
10	150.....	21.97	18.38	3.59	68.42	43.53	24.89
11	180.....	22.59	18.38	4.21	73.95	43.53	30.42
12	240.....	23.21	18.38	4.83	82.18	43.53	38.65
13	300.....	23.46	18.38	5.08	87.82	43.53	44.29
14	360.....	23.56	18.38	5.18	90.80	43.53	47.27
15	Over 360.....	23.65	18.38	5.27	94.22	43.53	50.69

(3) *Accumulation factors—60-day evacuation policy.*

	1	2	3	4	5	6	7
1	No. of days after hospitalization begins	Accumulation of patients per 1,000 strength based on admission rates of 1 per 1,000 a day each for disease and nonbattle injuries and for battle injuries and wounds and an evacuation policy of 60 days.					
		Disease and nonbattle injuries			Battle injuries and wounds		
		Total	T of Opns	ZI evacuees	Total	T of Opns	ZI evacuees
2	1.....	1.00	1.00	0	1.00	1.00	0
3	5.....	4.56	4.56	0	4.81	4.81	0
4	10.....	7.64	7.64	0	9.13	9.13	0
5	20.....	11.40	11.38	0.02	16.87	16.71	0.16
6	30.....	13.55	13.47	0.08	23.66	23.14	0.52
7	60.....	17.20	16.60	0.60	40.05	36.63	3.42
8	90.....	19.45	16.60	2.85	52.19	36.63	15.56
9	120.....	20.98	16.60	4.38	61.40	36.63	24.77
10	150.....	21.97	16.60	5.37	68.42	36.63	31.79
11	180.....	22.59	16.60	5.99	73.95	36.63	37.32
12	240.....	23.21	16.60	6.61	82.18	36.63	45.55
13	300.....	23.46	16.60	6.86	87.82	36.63	51.19
14	360.....	23.56	16.60	6.96	90.80	36.63	54.17
15	Over 360.....	23.65	16.60	7.05	94.22	36.63	57.59

(4) *Accumulation factors—30-day evacuation policy.*

	1	2	3	4	5	6	7
1	No. of days after hospitalization begins	Accumulation of patients per 1,000 strength based on admission rates of 1 per 1,000 a day each for disease and nonbattle injuries and for battle injuries and wounds and an evacuation policy of 30 days.					
		Disease and nonbattle injuries			Battle injuries and wounds		
		Total	T of Opns	ZI evacuees	Total	T of Opns	ZI evacuees
2	1.....	1.00	1.00	0	1.00	1.00	0
3	5.....	4.56	4.56	0	4.81	4.81	0
4	10.....	7.64	7.64	0	9.13	9.13	0
5	20.....	11.40	11.38	0.02	16.87	16.71	0.16
6	30.....	13.55	13.47	0.08	23.66	23.14	0.52
7	60.....	17.20	13.47	3.73	40.05	23.14	16.91
8	90.....	19.45	13.47	5.98	52.19	23.14	29.05
9	120.....	20.98	13.47	7.51	61.40	23.14	38.26
10	150.....	21.97	13.47	8.50	68.42	23.14	45.28
11	180.....	22.59	13.47	9.12	73.95	23.14	50.81
12	240.....	23.21	13.47	9.54	82.18	23.14	59.04
13	300.....	23.46	13.47	9.99	87.82	23.14	65.68
14	360.....	23.56	13.47	10.09	90.80	23.14	67.66
15	Over 360.....	23.65	13.47	10.18	94.22	23.14	71.08

d. Dispersion Factor. At any given time a certain proportion of the theater fixed beds will not be immediately available to patients because of "dispersion." (A 20-percent allowance for dispersion was generally used during World War II.) Factors contributing to dispersion are—

- (1) A certain number of beds must be packed and in transit. The greater the mobility of the troops the greater the allowance required.
- (2) Smaller troop units operating at some distance from the main body of troops must be supported by complete hospital units even though it is realized that the troop unit will not be likely to utilize fully the hospital facilities provided.
- (3) The general practice of prescribing separate wards for patients of different sexes, cases of contagious disease, and for cases requiring different types of treatment, necessitates a safety margin in each ward since the proportion of the various classes will vary from time to time.

168. Computations

Given these items of basic data, the fixed hospital bed requirements for a specific situation at a given time can be computed according to the following formula: (Note that a factor of 1.25 is applied to obtain a dispersion factor of 20% as defined in par. 167*d*.)

Example: Theater "A" has a troop strength of 500,000. Expected daily admission rates per 1,000 are as follows: disease and nonbattle injuries, 1.7; casualties, 0.6. Theater evacuation policy is to be 120 days. How many fixed hospital beds will be required at the end of 90 days?

	Rate	Accumulation factor	Troop strength thousands	Dispersion factor	
Disease and nonbattle injuries.....	1.7	$\times 18.38$	$\times 500$	$\times 1.25$	=19,529
Battle injuries and wounds.....	0.6	$\times 43.53$	$\times 500$	$\times 1.25$	=16,324
Total fixed beds required at the end of 90 days.....					35,853

169. Zone of Interior

a. Fixed beds are required in the zone of interior for those troops who do not depart for theaters of operations. When new recruits are being inducted in large numbers, morbidity tends to be rather high and beds equal in number to as much as 5 percent of the zone of interior strength may be necessary. After the period of training is over, beds equal in number to about 4 percent of the zone of interior strength may be sufficient.

b. It also is necessary to compute bed requirements for those cases evacuated from theaters of operations. These additional beds are estimated on the basis of the expected numbers of evacuees arriving in the United States (disease and nonbattle injury and casualty cases being separately considered) and the average duration of stay of such cases in zone of interior hospitals.

*Accumulation of Theater of Operations Patients in Zone of Interior Hospitals—
120-Day Evacuation Policy**

	1	2	3	4	5	6	7	8
1	Cause of admission	Daily hospital admission rate per 1,000	Accumulation of theater patients in zone of interior hospitals per 1,000 theater strength after number of days indicated following start of operations in the theater					
			60	90	120	180	360	540
2	Disease and nonbattle injury.....	1.0	0.60	1.07	1.50	3.11	4.08	4.17
3	Wounded.....	.6	2.05	5.20	8.79	16.32	26.43	28.48
4	Total patients.....		2.65	6.27	10.29	19.43	30.51	32.65
5	Increase by 25%.....		.66	1.57	2.57	4.86	7.63	8.16
6	Total beds required.....		3.31	7.84	12.86	24.29	38.14	40.81

*Based on July to December 1944 ETO admission rates.

c. To the above figures must be added an allowance, when appropriate, for care of *Navy, Air Force, allied military personnel, allied*

civilians, and prisoners of war. The additional number of fixed beds for such purposes will depend upon the particular area involved, and no definite figures can be given.

d. Experience in World War II indicates that an additional allowance should be made because some patients who are to be evacuated to the zone of interior still will be in the theater after 120 days due to a change in prognosis, transportation allocation, or other reasons.

Section III. TRANSPORTATION OF CASUALTIES

170. Capacity of Transportation

1	Type of transportation	2	3	4
		Men		
		Sitting	Recumbent	Average
2	Transport airplane (C-47).....	24	24	24
3	Transport airplane (C-46).....	50	33	41
4	Transport airplane (C-54).....	49	36	42
5	Transport airplane (C-82).....	41	34	37
6	Transport airplane (C-97).....	134	83	108
7	Transport airplane (C-119).....	42	35	38
8	Transport airplane (assault, C-123).....	60	50	55
9	Transport airplane (C-124).....	200	132	166
10	Army aircraft (LC-126A).....	3	2	2
11	Army aircraft (L-19).....	1		1
12	Army aircraft (L-20).....	5	2	3
13	Army aircraft (L-17).....	3		3
14	Army aircraft (L-23).....	5	3	4
15	Helicopter (H-5G).....	3	2	2
16	Helicopter (H-13).....		2	2
17	Helicopter (H-19).....	8	6	7
18	Helicopter (H-21).....	13	12	13
19	Helicopter (H-25).....	4	3	4
20	Ambulance, ¾ ton KD.....	8	4	6
21	Ambulance, ¾ ton, cross-country.....	8	4	6
22	Truck, ¾ ton.....	2	2	2
23	Truck, ¾ ton.....	8	5	6
24	Truck, 1½ ton.....	10	10	10
25	Truck, 2½ ton.....	16	18	17
26	Truck, 2½ ton, amphibian.....	12	12	12
27	Railway car, coach (US).....	52		52
28	Railway car, coach (foreign).....	54-72		54-72
29	Pullman car (US).....	48	32	40
30	Sleeping car (foreign).....	32	32	32
31	Ambulance Train (Rail).....	27	27	27
32	LVT.....	12	6	9
33	LCVP.....	36	17	26
34	LCM.....	60	15	37
35	LST.....	2 180	2 120	300
36	Bus, motor, 37 passenger, convertible.....	37	18	28

¹ Only 7 litters if LCVP is to be hoisted aboard for loading.

² In addition to recumbent patients.

³ In addition to sitting patients.

171. Time Element of Evacuation

Following are factors for evacuation of personnel (including loading and unloading):

a. Litter Squads.

(1) Average terrain, 4-man squad—1,000 yards and return in 1 hour.

(2) Mountainous terrain, 6-man squad—400 yards and return in 1 hour.

b. Ambulance, Motor, During Combat, in Division Area. Five miles and return in 1 hour.

c. Aircraft.

(1) Helicopter—50 miles *one way* in 1 hour.

(2) Transport airplane—100 miles *one way* in 1 hour.

(3) Army aircraft—75 miles *one way* in 1 hour.

172. Ambulance Requirements

Ambulance requirements for a continental land mass are as follows:

a. By army to clear automatically the division clearing stations:

Per infantry division, 15 ambulances.

Per armored divisions, 30 ambulances.

b. By corps for corps troops, 20 ambulances.

c. By army for army service area, 30 ambulances.

d. By advance section, communications zone, to clear army evacuation hospitals it is supporting, 10 ambulances per hospital (400- or 750-bed).

Section IV. ANIMALS

173. General

Noneffective rates and evacuation and hospital requirements for animals vary greatly with the age, type, and condition of the animals, and the nature and location of the operation in which they are engaged.

174. Noneffective Rate

The noneffective rate of horses and mules between the ages of 6 and 15 years, and of dogs between the ages of 2 and 5 years will be lower than for animals in younger or older age groups. It will be notably lower in trained and seasoned animals, and it will be normally lower in temperate zones than in the tropics. Availability and use of proper rations, water, shelter, and rest periods also are important factors. The noneffective rate will be unduly high where untrained, incompetent, or poorly supervised personnel are employed. About 45 percent of all horses and mules and about 20 percent of all dogs (at war dog reception and training centers only) admitted to sick report

during World War II required hospitalization. The noneffective rate per 1,000 strength during World War II was as follows:

Area	Horses			Mules		
	Disease	Injury	Total	Disease	Injury	Total
Entire Army 1942-1945.....	19	23	42	15	17	32
Zone of Interior 1942.....	15	25	40	12	14	26
MTO, 1944.....	94	64	158	30	44	74
CBI, 1944.....	55	55	110	19	20	39

This chart covers periods of approximate peak strength or activities. Animals in the Mediterranean Theater of Operations were engaged in active operations over 50 percent of the period and in China-Burma-India over 25 percent.

175. Evacuation Policy

a. The system of evacuation of animal casualties closely parallels that of personnel casualties, except that evacuation from a theater of operations to the zone of interior is not contemplated and those which are incurably sick or wounded are destroyed as soon as detected.

b. The evacuation policy is established by the theater commander and is predicated on a combination of two principles—first, that tactical units be relieved of animal casualties adequately to allow such units to maintain necessary mobility; second, that no animal be evacuated farther than is necessary in the best interests of the patient's recovery. Those requiring short periods of hospitalization usually are evacuated to a veterinary field hospital or comparable unit in the service area at once. Those requiring longer periods usually are evacuated to a veterinary general hospital or comparable unit in the communications zone. In line with this policy, forward units in the chain of evacuation are utilized to their fullest capacity commensurate with the situation.

176. Length of Hospitalization

The average period of treatment for horses and mules requiring hospitalization during World War II was 27 days. The average for war dogs was 20 days. This does not include quarantine periods.

177. Hospital Stall Requirements

Hospital stall requirements per 1,000 strength will approximate the following:

1	1	2	3	4
		In active theaters	In the zone of interior	
			Seasoned	Unseasoned
2	Pack animals (horses and/or mules).....	150	35	100
3	Dogs.....	60	35	60

178. Evacuation Requirements and Capacities

a. Requirements. Estimates for ambulance requirements are based upon the anticipated hospitalization rate, evacuation policy, and length of the evacuation chain. Normally, all animals are evacuated by motor (ambulance or truck). Rail transportation may be used where practical. Animals may be evacuated by walking, but because of the adverse effects on the patient, this practice should be avoided except for short distances.

b. Means and Capacities.

<i>Means of evacuation</i>	<i>Capacity, pack animal (horse or mule)</i>
Trailer, 2-horse, van.....	2
Truck, 1½-ton, cargo.....	2
Truck, 2½-ton, cargo*.....	4
Semitrailer, 6-ton, combination animal and cargo.....	8
Railroad stock car, 40-ft.....	25 (approx)
Railroad stock car, 36-ft.....	20-22 (approx)
Veterinary lead line (walking).....	20
Airplane, transport (C-47).....	4 or 6
Airplane, transport (C-119).....	15 (approx)
Airplane, transport (C-124).....	40 (approx)

*The 2½-ton cargo truck equipped with standard body with or without modifications (preferably with stock rack) will hold four animals and usually is the most efficient means of evacuating seasoned animals over difficult terrain.

179. Veterinary Units

a. Evacuation units are the Veterinary Evacuation Detachments, teams ID and IE (TOE 8-500).

b. The service unit is the Veterinary Animal Service Detachment, team IC (TOE 8-500).

c. Hospital units are the Veterinary General Hospital (TOE 8-750), the Veterinary Field Hospital (TOE 8-780), and the Veterinary Hospital Detachments, teams IA and IB (TOE 8-500).

CHAPTER 7

LOGISTICS—TRANSPORTATION

Section I. GENERAL

180. Chapter Contents

Transportation data and methods of computing transportation requirements are presented in 11 sections as follows:

Section I. General.

II. Pipelines.

III. Inland waterways.

IV. Railways.

V. Movement of troop units by rail.

VI. Highway transport.

VII. Helicopters.

VIII. Miscellaneous transport modes.

IX. Terminals.

X. Fixed wing transport aircraft.

XI. Ocean transport.

181. Transportation Estimates and Plans

a. Transportation estimates and plans are necessarily dependent upon the user of transportation, whose firm requirements are often not available until after tactical plans and supply service plans have been completed. In order for transportation planners to plan concurrently with other staff agencies, it is often necessary for them to adopt methods of utilizing troop strength and requirement factors that will permit a reasonable estimate of transportation requirements in broad terms, to be defined at a later date in terms of class and service (or item) of supplies and categories of personnel or troop units.

b. Transportation planning usually progresses in the following steps:

- (1) The first step in transportation planning is to survey existing and potential facilities for movement of troops and supplies.
- (2) Based upon a study of these facilities, select the means of movement most efficient under the conditions.
- (3) Plan to use the more efficient means as far forward as practicable, and with a minimum waste of effort in rehandling cargo.

- (4) In addition to the principles of military economy, the transportation plan in the forward area must provide for tactical flexibility. The desired flexibility usually is supplied by highway trucks working from the forward end of rail, water, and pipeline facilities. Supply by air may be used to supplement or replace other means.

182. Capacities of Lines of Communications

a. The capacities of lines of communications are quantitative statements of the ability of the lines to transport cargo or troops, and are usually expressed in tons (long or short) or troops per day. Frequently, troops per day may be equated to tons per day to provide a common unit of measure. A ton-mile is the actual forward movement of one ton one mile.

b. Capacities are dependent upon the following:

- (1) Density of movement, which is dependent upon the physical character of the way (waterway, railway, highway, airway, etc.) and its terminals.
- (2) Number and lift capacities of available transportation mediums.
- (3) Turn-around time (time required for a complete cycle of movement), which is dependent upon speed of transport mediums; speed of loading and unloading; and time consumed in maintenance, miscellaneous delays, and operation en route.
- (4) Efficiency of management and maintenance organization.

c. Capacities may be calculated by the following formulas for the cases stated below:

- (1) *Case I.* Where the number of transport mediums available is sufficient to achieve maximum density (saturate the way)—

$$\text{Daily capacity} = \text{lift capacity of single medium} \times \text{density of movement per day}.$$
- (2) *Case II.* Where number of transport mediums is limited (less than sufficient to achieve maximum density)—

$$\text{Daily capacity} = (\text{number of operational transport mediums} \times \text{lift capacity of single medium}) \div \text{turn-around time in days}.$$

d. Efficiency of management is an intangible factor, which may enter arithmetical calculations of capacity only by experience or estimate. Such efficiency is dependent on number and skill of operating personnel, degree of intelligent movement planning, and effectiveness of operating technique.

183. Advance Transportation Planning Factors

When it is desirable to obtain an estimate of transportation requirements well in advance of detailed planning, the following general averages may be used:

a. Cargo Ships.

Capacity----- 5,600 short tons of Army cargo.*
 Discharge rate----- 720 short tons per day discharging alongside berth.
 Discharge rate----- 720 short tons per day discharging in stream.
 Beach capacity----- 1,680 short tons per 1,000 yards of beach.
 Amph trk capacity---- 720 short tons per amphibious truck company per day.

*See paragraph 240a.

b. Shipping Requirements for an Assault Division Slice of 25,000 Men.

Type	Extended voyage (10 days)	Short voyage (2-3 days)
AGC (Amphibious Forces Flagship)-----	1	-----
APA (Transport, attack)-----	15	9
AKA (Cargo ship, attack)-----	7	6
LST (Landing ship, tank)-----	22	36
LSM (Landing ship, medium)-----	14	12
LSD (Landing ship, dock)-----	7	3
LCU (Landing ship, utility)-----	32	-----

c. *Percentage of Organizations and Supply Moved in Assault or Cargo Craft in Amphibious Operations.* Supply as used below refers to accompanying supply. After the assault phase, supply is by cargo shipping only, except for emergency supply. Percentages are as follows (to be used only when assault lift is not known):

- (1) Eighty percent of the total personnel moved in assault naval shipping.
- (2) Twenty percent of the total personnel moved in cargo type shipping.
- (3) Sixty percent of the organizational equipment and supplies for units moved in assault naval shipping will accompany the units transported in that shipping.
- (4) Forty percent of the organizational equipment and supplies for units moved in assault naval shipping will be transported in cargo type shipping.
- (5) Due to space or other factors, it sometimes is not possible to move all of the organizational equipment and supplies of a unit on the same ship. These supplies and equipment in such case may be moved on another ship of the same convoy providing sufficient personnel from the parent unit accompany them.

d. *Railways (Foreign countries)* ¹

(1) *Standard gage (56½")*.

Single track-----	10 trains (4,000 short tons) per day in each direction (will support about two corps).
Double track-----	30 trains (12,000 short tons) per day in each direction (will support about 18 divisions).
Train load-----	400 short tons of cargo (20 cars at about 20 tons each) or 1,000 troops (40 boxcars at 25 troops each).

(2) *Narrow gage (36", 39½" and 42")*.

Single track-----	10 trains (3,000 short tons) per day in each direction.
Train load-----	3,000 short tons of cargo (20 cars at about 15 tons each) or 500 troops (20 boxcars at 25 troops each).

e. *Highways*.

(1) *Highway tonnage capability*.²

Dirt-----	0-500 short tons/day fwd
Gravel-----	300-1500 short tons/day fwd
Bituminous-----	1000-8000 short tons/day fwd
Concrete (good condition)-----	6000-10000 short tons/day fwd

(2) A hard-surfaced, 2-lane road of high type asphalt, macadam or equivalent will support a corps of four or five divisions.

(3) Trucks required to move the foot troops of an infantry division—261 vehicles in addition to all organic division vehicles. Equivalent to about 6 light truck companies equipped with 2½ ton 6 x 6 trucks.

(4) A Transportation Light Truck Co (TOE 55-17R) equipped with 2½ ton 6 x 6 cargo trucks is capable of moving 540 short tons of general cargo for local hauls daily or compiling 10,125 forward ton-miles daily on line or long hauls. (Not augmented and operating w/1.6 drivers per truck for 10-15 hours daily. When augmented and operating w/2.0 drivers per truck for 20 hours daily these figures increase from 540 to 720 short tons and from 10,125 to 13,500 forward ton-miles daily).

f. *Pipelines*. A 6-inch pipeline will transport 1,842 short tons of petroleum products per day and will support three corps (par. 185).

g. *Air Transport*. To transport the initial echelon of an infantry

¹ New car load (payload) is computed at 50 percent of its rated capacity for planning purposes. US equipment overseas box, gondolas and flat cars 40 tons rated capacity (standard gage) 30 tons rated capacity (narrow gage).

² No exact formula has been developed for determining the capabilities of various types of roads and highways because of many variable factors which must be considered. These capabilities are based on following assumptions (1) operation is sustained, (2) necessary road maintenance is performed, (3) each road bears two lanes of traffic, permitting movement in both directions, (4) standard cargo trucks 2½ T 6 x 6 are used, (5) two-thirds of the capability of the road is used for civil and/or other military traffic normal to a theater of operations.

division by air requires 662 C-119 or C-123 type aircraft. Sufficient personnel, weapons, and vehicles are included so that the infantry division can operate with the same degree of combat effectiveness as the assault echelon of an airborne division. For detailed aircraft requirements, see paragraph 56.

Section II. PIPELINES

184. Capacity

The capacity of a pipeline system varies with the length, gradient, and condition of the lines and with the power and efficiency of the pumps. For planning purposes, the following capacities may be used:

	1	2	3
1	Pipe diameter	Gallons per day	Net short tons per day (motor gas)
2	4-inch.....	288, 000	883
3	6-inch.....	600, 000	1, 842
4	8-inch.....	1, 670, 000	5, 123

185. Capability

Generally, a 6-inch pipeline can maintain 3 corps, totaling not more than 12 divisions. (For construction materials and operating unit requirements, see sec. II, ch. 8.)

Section III. INLAND WATERWAYS

186. General

a. *Types.* Inland waterways include all navigable inland waters such as rivers, lakes, inland channels, and canals of sufficient depth to accommodate cargo traffic. The following are the general types into which inland waterways are grouped:

- (1) Lakes.
- (2) Rivers.
- (3) Ship canals.
- (4) Barge canals.
- (5) Intracoastal waterways.

b. *Characteristics.* The characteristics of a waterway which must be considered in an analysis of its capabilities are as follows:

- (1) Restricting widths and depths of channel.
- (2) Vertical and horizontal bridge clearance.
- (3) Location of dams and other bars to navigation.
- (4) Location of locks, dimensions, and timing.
- (5) Seasonal floods and droughts, their frequency and duration.

- (6) Normal freeze-up and opening dates.
- (7) Hazards to navigation such as rapids and falls.
- (8) Speed and fluctuation of current.
- (9) Waterway maintenance requirements.
- (10) Changes of channel.

187. Waterway Capacity Estimates

a. Limiting Factors. Factors, other than waterway characteristics, having a limiting effect on waterway capacity are—

- (1) Availability of suitable barges or craft.
- (2) Availability of suitable operating personnel.
- (3) Availability and adequacy of terminals and terminal facilities.

b. Turn-Around Time. This factor is defined as the time required for a barge or craft to load, travel to destination, unload, return to origin, and be ready to resume loading. It has considerable effect on waterway capacity and involves—

- (1) Length of haul, taken as round trip distance.
- (2) Speed in still water—4 miles per hour.
- (3) Speed and direction of current.
- (4) Loading and unloading time—computed at 8.4 short tons per barge per hour.
- (5) Time consumed in locks.
- (6) Operating hours per day—normally taken as 20, allocating the remaining 4 for maintenance, refueling, restoring, etc.

c. Capacity Determination, Craft Available To Fill or Exceed Waterway Capacity. When sufficient barges or craft are available to fill or exceed waterway capacity, the daily tonnage that may be moved over the waterway is equal to one-half the number of craft per day that can be passed through the most limiting constriction (example, a lock, lift bridge, narrow channel, etc.) times the average net capability of the craft in use.

d. Capacity Determination, Craft Not Available To Fill or Exceed Waterway Capacity. The following formula may be used to determine the number of tons a given number of barges can transport a given distance daily:

$$\frac{\text{Number of barges} \times \text{tons per barge} \times \text{hours of operation per day}}{\text{Turn-around time in hours}} = \text{tons moved daily}$$

Example: Determine the daily tonnage 20 barges of 270 short tons capacity each can move 60 miles forward with no lost time in locks and negligible effect due to current.

$$\text{Travel time per barge} = \frac{60 + 60}{4} = 30 \text{ hours}$$

$$\text{Loading and unloading time per barge} = \frac{2 \times 270}{8.4} = 64.3 \text{ hours}$$

$$\text{Turn-around time per barge} = 30 + 64.3 = 94.3 \text{ hours}$$

$$\frac{20 \text{ barges} \times 270 \text{ tons per barge} \times 20 \text{ hours daily availability}}{94.3 \text{ hours turn-around time}} = 1,145.3 \text{ short tons daily}$$

188. Floating Equipment Requirements

a. Cargo Craft. To determine the number of barges or cargo craft required to move a given tonnage a given distance forward daily, use the following formula:

$$\frac{\text{Daily tonnage} \times \text{hours turn-around time}}{\text{Tons per barge} \times \text{hours of operation daily}} = \text{Number barges required}$$

Example: Determine the number of barges having a capacity of 500 short tons required to move 1,000 short tons daily a distance of 100 miles forward, assuming no lost time in locks and negligible effect due to current.

$$\text{Travel time per barge} = \frac{100 + 100}{4} = 50 \text{ hours}$$

$$\text{Loading and unloading time per barge} = \frac{2 + 500}{8.4} = 119 \text{ hours}$$

$$\text{Turn-around time per barge} = 50 + 119 = 169 \text{ hours}$$

$$\frac{1,000 \text{ tons daily} \times 169 \text{ hours turn-around}}{500 \text{ tons per barge} \times 20 \text{ hours daily operation}} = 16.9 \text{ barges} = 17 \text{ barges required}$$

b. Tugs and Towboats. Since a single tug or towboat can normally be used to tow more than one barge, and loading time is not a consideration in tug or towboat availability, it follows that fewer tugs than barges will be required in any given situation. To determine the number of tugs or towboats required to efficiently operate a given number of barges in a given situation, use the following formula:

$$\text{Number of tugs} = \frac{\text{Total number of barges} \times \text{turn-around time for tugs in days}}{\text{Number of barges per tow} \times \text{turn-around time for barges in days}}$$

Example: Determine the number of tugs required to operate 400 barges, where each tow consists of 5 barges, turn-around time for barges is 4 days, and turn-around time for tugs is 2 days.

$$\frac{400 \text{ barges} \times 2 \text{ days tug turn-around}}{5 \text{ barges per tow} \times 4 \text{ days barge turn-around}} = 40 \text{ tugs required}$$

Section IV. RAILWAYS

189. General

Railway construction data are contained in chapter 8.

a. Estimates of railway capacity, operating personnel, equipment, and supply requirements for a specific railway line should take into consideration the basic characteristics of the line, the nature of the country in which the operation is planned, and the purpose for which the planning is being done. The following items are considered essential to intelligent appraisal. If these are not available, their effects upon the operation must be assumed, based on overall information of railroad operations within the country involved.

- (1) Length of line.
- (2) Condition of roadbed and track.
- (3) Gage of track.*
- (4) Single, double, or multiple track.
- (5) Weight of rail.
- (6) Type of ballast and depth.
- (7) Type of ties (if wood, treated or untreated).
- (8) Tie spacing.
- (9) Axle load limitations (track and bridge).
- (10) Profile of line showing location and length of ruling grade.
- (11) Alinement of line showing location and length of minimum radius curves.
- (12) Location and description of bridges and tunnels.
- (13) Location and length of passing tracks.
- (14) Location, type and quantity of fuel supply.
- (15) Location, quantity and quality of water supply.
- (16) Location and capacity of yards.
- (17) (a) Location and capacity of car repair tracks and engine-houses.
(b) Location and capacity of heavy repair shops.
- (18) Type and availability of motive power.
 - (a) Weight in working order.
 - (b) Expected working tractive effort.
 - (c) Age.
- (19) Type and availability of rolling stock.
 - (a) Capacity and dimension.
 - (b) Age.
- (20) Allowable draw-bar pull.

*Track gages vary widely starting at 1 foot 11¾ inches and going to 5 feet 6 inches. The most widely used gages are—

	Broad	Standard	Narrow
5 ft. 6 in.			3 ft. 6 in.
5 ft. 3 in.		4 ft. 8½ in.	3 ft. 3¾ in.
5 ft. 0 in.			3 ft. 0 in.

- (21) Diagrams showing minimum structure, maximum unrestricted loading and equipment gages.
- (22) Signal system.
- (23) Dispatching facilities.
- (24) Route junctions.
- (25) Availability of new equipment and spare parts.
- (26) Indigenous labor resources.

b. A military railway operating division will vary from approximately 90 to 150 miles depending upon existing conditions. For general planning purposes, however, an average of 100 miles per railway division may be assumed.

190. Evaluation and Planning

Paragraphs 191 through 199 are designed primarily for wartime estimates of railway operations in a theater of operations. Analytical refinements and elaborate train density studies are difficult to justify and have been avoided because of the lack of basic information and the relative uncertainty inherent in military operations. The planner should also bear in mind that in the early stages of a war, indigenous equipment and labor may be utilized to a large extent which again may vary the expected tonnage capacity.

191. Train Density

Train density is the number of trains per day which can be operated in each direction over a railway line. Work trains are not included in train density. Train densities will vary, depending upon the condition of track, location and length of passing sidings, adequacy of terminal facilities, and availability of motive power and rolling stock. Densities recommended below are averages based on experience under theater of operations conditions. After air superiority has been attained, the intensity of combat has been reduced, and dependent upon judgment of operating conditions, densities achieved may be expected to exceed by 20 percent those presented below. (For planning capacities, see par. 183*d*.)

Single track lines*----- 10 trains per day in each direction.

Double track lines----- 30 trains per day in each direction.

Multiple track lines----- The extra tracks will be used to rehabilitate and maintain two tracks in operation under most theater of operation conditions.

*Passing track intervals of 6 to 8 miles.

192. Net Train Load

The net train load, or pay load, carried by trains on different divisions of the same line may vary greatly, depending upon the conditions of operation. Experience indicates that, under normal theater of operations conditions over standard gage railways, a net train load of 400 short tons may be used as an *average* for general planning purposes. On narrow gage railways, a net train load of 300 short tons may be used.

193. Net Division Tonnage

a. Net division tonnage is the net tonnage (short tons) or pay load which can be moved over a railway division each day.

Formula:

Net division tonnage = (train density) × (average net train load)

b. Troop, hospital, or other special trains will replace an equal number of tonnage trains and, when operation of such trains is anticipated, the factor for train density must be so adjusted with the resulting decrease in net division tonnage.

c. A reduction must be made in the pay load to compensate for supplies required to operate the railroad. This reduction is estimated at 5 percent of the net load for each division after the first, in its relation to the source of fuel and supplies.

194. Equipment Estimation

Planning data included herein are based on use of standard U. S. Transportation Corps equipment. Allowances for use of indigenous or captured equipment should be based on judgment after evaluation of the many factors involved, such as availability of equipment, extent of expected destruction, condition of equipment, types and local availability of fuel, availability of spare parts, types of coupling devices, etc. Data are available in logistic surveys, special transportation studies based on intelligence reports, reports of governments or railroads in peacetime, and from articles appearing in such publications as *Railway Gazette* (British) and *Railway Age* (United States).

a. *Road Engines.* The following data are recommended for general planning purposes. Computation of requirements should be made for each division separately.

Average rate of travel from division terminal to division terminal—eight miles per hour.

Time in each division terminal for steam locomotives—8 hours.*

Time in each division terminal for diesel-electric locomotives—3 hours.*

Reserve engines, to allow for unforeseen circumstances such as operational peaks, heavy repairs, or destruction—20 percent.

Formula:

Number required for division= $TD \times \frac{RT+TT}{24} \times 2 \times RF$,

where

TD=train density, one way.

RT=average running time in hours.

TT=terminal time at one end of the division.

24=number of hours in a day.

RF=operational reserve factor=1.20.

b. Switch Engines.

- (1) Switch engine requirements at port terminals, division terminals, railheads, and depots are dependent on the physical track layout and the number of cars required to be handled at such points. The following may be used as a general guide only.

Location	Switch engines required †
Port terminals or base of operations.....	1 per 50 cars dispatched and received per day.
Division terminals.....	1 per 100 cars passing per day.
Railhead classification.....	1 per 100 cars dispatched and received per day.
Depots.....	1 per 50 cars dispatched and received per day.

† Either steam-powered or diesel-electric.

- (2) Requirements computed as above should be increased by 30 percent to allow for unforeseen circumstances, repairs, etc.

c. Rolling Stock.

(1) Freight.

- (a) Requirements are computed separately for operations be-

*Allows time for locomotive servicing, running repairs, and time lost between enginehouse and yards.

tween major supply installations or areas on each LOC as follows:

$$\text{Number of cars} = \frac{\text{daily tonnage}}{\text{average tons per car}} \times \text{turn around time}$$

Turn around time is the total estimated number of days required for a car from the time it is placed for loading at its point of origin, moved to its destination, unloaded, and returned to its point of origin. Such time may be computed as follows: allow 2 days at origin, 1 day at destination, and 2 days transit time for each division (or major portion thereof) which the cars must traverse. This method, rather than an actual hour basis, is used to incorporate delays due to terminal and way station switching as well as in-transit rehandling of trains.

- (b) Computations should be increased by 10 percent to meet operational peaks, commitments for certain classes of cars, and bad order cars.
- (c) An average planning factor for net load per car may be assumed as follows:

<i>Standard gage to broad gage.</i>	
U. S. equipment.....	20 tons.
Foreign equipment.....	10 tons.
<i>Narrow gage</i>	
U. S. equipment.....	15 tons.
Foreign equipment.....	7½ tons.

- (d) Tank car requirements are computed separately based on the bulk POL requirement and the computed turn around time.
- (2) *Passenger.*
- (a) Passenger car requirements will vary, depending upon troop movement policies, evacuation policies, and rest and recuperation policies.
 - (b) Theater passenger car requirements are normally fulfilled by acquisition of local equipment, with the exception of hospital cars or trains.

195. Characteristics of U. S. Rolling Stock

Type of car	Gage (in.)	Capacity			Tare weight (empty) (tons)	Inside dimensions		
		Cubic feet	Tons	Load limit (tons)		Length	Width	Height
Box (30 ton)-----	36	1,484	30	33	-----	34' 5½"	7' ¾"	6' 1¾"
	39¾							
	42							
Box (40 ton)-----	56½	2,345	40	44	-----	40' 6"	8' 6"	6' 9¾"
	60							
	63							
Flat (30 ton)-----	66	-----	30	33	-----	34' 8½"	7' 2"	-----
	36							
	39¾							
Flat (40 ton)-----	42	-----	40	44	-----	40' 9"	8' 7½"	-----
	56½							
	60							
Flat (80 ton)-----	63	-----	80	88	-----	46' 8"	10' 1"	-----
	66							
	56½							
Flat, depressed center (60 ton).	60	-----	60	66	-----	-----	-----	-----
	63							
	66							
Gondola, high side (30 ton).	56½	-----	30	33	-----	34' 5"	6' 10½"	4'
	36							
	39¾							
Gondola, high side (40 ton).	42	-----	40	44	-----	40' 5½"	8' 3¾"	4'
	56½							
	60							
Gondola, low side (30 ton)---	63	-----	30	33	-----	34' 6"	6' 11½"	1' 6"
	66							
	36							
Gondola, low side (40 ton)---	39¾	-----	40	44	-----	40' 4½"	8' 3¼"	1' 6"
	42							
	56½							
Tank, P.O.L (5,000 gal.)----	60	687	5,000 gal.	30	-----	Outside 31' 6"	Diam. tank 5' 3¼"	-----
	63							
	66							
Tank, P.O.L (10,000 gal.)----	36	1,367	10,000 gal.	40	-----	Outside 38' 5¾"	Diam. tank 6' 8¾"	-----
	39¾							
	42							
Refrigerator (30 ton)-----	56½	836	30	33	-----	28' 10"	6'	4' 10"
	60							
	63							
Refrigerator (40 ton)-----	66	1,477	40	44	-----	34'	7' ½"	6' 2"
	36							
	39¾							
	42							
	56½							
	60							
	63							
	66							
	56½							

NOTE

Average pay load of each type of car, except tank cars, is 50 percent.

196. Outsize Equipment

Outsize equipment is that equipment which, because of extreme dimensions (height, width, length) or extreme weight or combinations of the above, will require special handling under restricted speeds and/or on special cars. The planner should recognize the fact that more and more of this type of equipment is being designed and should attempt to build a train of these outsize loads for a single movement rather than assume a few in each train moving on the LOC. Such movements require special meeting points on adjacent lines of a double track LOC and will retard traffic returning to its point of origin as well as following trains in the same direction.

197. Personnel Requirements

The basic unit of railway organization in a theater of operations, as in the United States, is the railway division. Military organizations of administrative and operating personnel are designed to fulfill the operating personnel needs of the basic units (railway divisions) and the administrative personnel needs of the several divisions comprising a system of railways. Personnel requirements are therefore estimated by division.

198. Administrative and Operating Organizations

a. Administrative. The following organizations are administrative: Headquarters and headquarters company, transportation military railway command (TOE 55-302). Normal requirement: one per two or more railway groups.

Headquarters and headquarters company, transportation military railway group (TOE 55-202). Normal requirement: one per two to six transportation railway operating battalions and one or two transportation railway shop battalions.

b. Operating.

(1) *Transportation railway operating battalion.*

(a) Requirements are estimated on the basis of the number of train crews required. The 50 train crews provided in the one transportation company of the battalion became the controlling factor. Where augmentation is necessary, additional crews are provided by TOE 55-500, Transportation Corps Service Organization. This augmentation does not upset the equilibrium of the battalion for carrying out its assigned function, provided the normal length of line to be operated (90-150 miles) is not exceeded or motive power added exceeding the capabilities of Company B for equipment maintenance. Normally, one railway operating battalion is assigned to one railway division.

(b) In estimating train crew requirements, the following basis may be used:

1. *For road operations.* One crew per train per day (moving in either direction) per division.
2. *For switching.* Two crews per switch engine in operation. (For general planning purposes, reserve switch engines are not considered.)
3. *For road operations and switching.* Assume 80 percent availability of assigned crews to allow for sickness and other absences.

(2) *Transportation railway shop battalion.* Under normal requirements one shop battalion may be expected to support depot maintenance for 100 steam locomotives, 200 diesel-electric locomotives, and 2,500 cars or perform depot maintenance monthly for 10 steam locomotives, 25 diesel-electric locomotives and 600 cars. Exact requirement should be tempered by judgment and the overall railway plan for the theater.

199. Supply

- a. *Fuel and Lubricants.* (See pars. 92-102.)
- b. *Spare Parts.* Estimated spare parts requirements for motive power and rolling stock: 1.5 short tons per month for each train per day (moving in either direction) over each division.

Section V. MOVEMENT OF TROOP UNITS BY RAIL

200. Space Requirements for Troop Loading on United States Equipment

For planning purposes and staff training, the following assumptions may be used:

a. *Sleeping Cars, Average.* Twenty-six troops in United States equipment (standard pullman), 30 in tourist sleepers, and 45 in troop sleepers.

- (1) Officers and warrant officers will be moved in standard pullmans, two per sections. They should be listed in number of sections (*example:* 14 officers, show as 7 sections) as officers and warrant officers of all units in one train will be grouped in one or more pullman cars as required.
- (2) Enlisted men will be moved in tourist pullmans, two per section. Allowances should be made for personnel attached from medical battalions and personnel detached for guards on freight cars.

b. *Coaches, Average.* Fifty-five troops with individual equipment.

c. Passenger Trains (typical for long distance troop moves). Eleven sleeping cars, two kitchen cars, and one or two baggage cars—average 350 troops per train.

d. Freight Trains. For troop unit moves, including heavy equipment such as tanks, artillery, and engineer equipment; trains seldom exceed—

Infantry divisions—65 cars or 650 tons.

Armored divisions—55 cars or 1,200 tons.

e. Mixed Trains. Mixed trains which carry all the personnel with their vehicles, artillery, and equipment are desirable from a tactical and organizational standpoint. Such moves are not economical when passenger equipment is in short supply, as mixed trains move at freight speed. In mixed trains, boxcars may be substituted for baggage cars.

201. Loading of Organizational Equipment

a. The amount of headquarters, kitchen, and maintenance equipment varies somewhat in all units. For planning purposes, allow 20 short tons per company or equivalent unit.

b. Organizational equipment moves under freight rates and normally will be loaded in unit transportation. If loaded separately, additional box cars will be required. Checkable baggage up to 150 pounds per individual is carried free. Three hundred and fifty pounds of checkable baggage is permitted in moves to ports of embarkation. Normally, this will be loaded in baggage or boxcar. When transportation groupings permit, checkable baggage for two companies or similar units may be loaded in one boxcar.

202. Kitchen-Baggage and Flat Cars

a. Kitchen-baggage and kitchen cars are furnished on the basis of one per 250 men or fraction thereof. Kitchen-baggage car requirements per train are dependent upon transportation groupings. For tentative estimates, allow one per unit.

b. Compute flat cars (or drop-end gondolas) required on basis of maximum utilization of each car, regardless of length. Do not restrict computation to cars of all one length. Twelve inches at one end of each car must be left for brake-wheel clearance. For detailed approved methods of loading vehicles and equipment, see Association of American Railroads booklet, "Rules Governing the Loading of Mechanized and Motorized Army Equipment"; also, "Major Caliber Guns for the United States Army and Navy, on Open Top Equipment."

203. Recommended Loading of Typical Vehicles and Equipment

	1	2	3
1	Equipment	Rail car	Units per car
2	Tank, light, M24.....	40 ft flat	2
3	Tank, medium, M4A3 and similar types.....	42 ft flat	2
4	Tank, medium, M45 and tank, heavy, M26.....	40 ft flat	1
5	Truck, ¼-ton.....	50 ft flat	8
6	Truck, ¾-ton, weapons carrier.....	42 ft flat	3
7	Truck, 2½-ton, cargo LWB.....	50 ft flat	2
8	Truck, 2½-ton, cargo SWB.....	50 ft flat	2
9	Truck, 4-ton, wrecker.....	40 ft flat	1
10	Truck, 10-ton, wrecker.....	40 ft flat	1
11	Truck, trailer, tank transporter, 45-ton.....	40 ft flat	1
12	Truck, tractor, 6-ton.....	40 ft flat	2
13	Vehicle, tank recovery, M32.....	42 ft flat	2
14	Vehicle, utility, armored, M44 (or equivalent).....	42 ft flat	2
15	Carriage, motor, M19.....	50 ft flat	2
16	Carriage, motor, multiple gun, M16.....	50 ft flat	2
17	Howitzer, 105-mm.....	40 ft flat	2
18	Howitzer, 155-mm.....	40 ft flat	1

204. Infantry Division and Armored Division Rail Moves

The following tables show samples of various combinations of rail equipment that could be used to move infantry and armored divisions. The specific types of equipment to be used and the detailed make-up of each train must be worked out between the unit transportation officer and the local railroad representative.

a. Infantry Division. Eighteen thousand troops—17,000 tons (vehicles and major equipment).

	1	2	3	4	5
1	Types of loading	Passenger equipment			Cars (F)
		Sleepers (S)	Kitchen (K)	Baggage (B)	
2	Separate loading:				
	51 passenger trains (11S 2K 2B).....	561	102	102	-----
	26 freight trains, 65 cars each (655 tons per train).....				1,690
	77 trains.....Totals.....cars.....	561	102	102	1,690
3	Mixed trains:				
	4 trains (6S 1K 38F).....	24	4	-----	152
	60 trains (9S 2K 28F).....	540	120	-----	1,680
	64 trains.....Totals.....cars.....	564	124	-----	1,832
4	Combination move:				
	26 passenger trains (11S 2K 2B).....	286	52	52	-----
	46 mixed trains (6S 1K 38F).....	276	46	-----	1,748
	72 trains.....Totals.....cars.....	562	98	52	1,748

b. Armored Division. Fifteen thousand troops—31,000 tons (vehicles and major equipment).

1	1	2	3	4	5
	Types of loading	Passenger equipment			Cars (F)
		Sleepers (S)	Kitchen (K)	Baggage (B)	
2	Separate loading:				
	43 passenger trains (11S 2K 2B).....	473	86	86	-----
	26 freight trains, 52 cars each (1,100 tons per train).....				1,352
	69 trains.....Totals.....cars.....	473	86	86	1,352
3	Mixed trains:				
	67 mixed trains (7S 1K 21F).....	469	67	-----	1,407
4	Combination move:				
	11 passenger trains (11S 2K 2B).....	121	22	22	-----
	50 mixed trains (7S 1K 28F).....	350	50	-----	1,400
	61 trains.....Totals.....cars.....	471	72	22	1,400

205. Weight of Tracked Vehicles

The tracked and half-tracked vehicles of the divisions, with their towed loads, make up approximately the following tonnages:

Infantry division..... 10,000 tons.
 Armored division..... 24,000 tons.

(In theater of operation and for mixed trains in the United States, the crews and other troops which normally travel in or on the tracked vehicles usually will ride on the same train.)

206. Movement of Troop Units on Foreign Railways

a. The capacity of railroads and railway equipment fluctuates widely throughout the nations of the world. Experience in Europe during World War II indicates that under the pressure of all-out war, there are few, if any, places in the world where complete troop units can be moved by rail at the same time that the rail net is supplying a major force. A compromise policy was developed in which tracked vehicles and foot troops were moved by rail whenever facilities were available and wheeled vehicles with their normal towed loads proceeded on highways.

*b. Assumed Capacity of Foreign Rail Facilities.**(1) Freight Cars.*

War flats.....	50 tons.
Medium flat cars.....	25 tons.
Small flat cars.....	12 tons.
Box cars.....	10 tons or 25 troops.

(2) Passengers.

Coaches*.....	40 troops.
Sleeping cars*.....	32 troops.

*In the forward areas, passenger equipment is seldom used for unit moves. The limited amount of available equipment may be used for movement of casualties, convalescents, redeployment groups, or leave trains

(3) Trains (foreign).

Maximum length.....	40 cars.
Maximum net load.....	400 tons.
Maximum troops 1,000 (using box cars).	

207. Troop Movement Planning

a. Scales. In training and preparation for movement, all units will become familiar with the use of railway car loading scales (par. 208) or equivalent scales, tables, or templates.

b. Rail Movement Table. Tables are to be maintained by all units for movement by *all modes* of transportation (SR 55-720-1).

c. Types of Tables. When the rail movement has been ordered and the approximate types of equipment requested, the following tables must be prepared by each unit:

Train consist table (par. 210).

Entraining table (par. 211).

Individual train-loading plan (par. 212).

d. Alert Time—(Zone of Interior.) An alert is not an order and rail carriers do not move equipment into position for loading on an alert. It requires 48 hours after receipt of orders by the Chief of Transportation to start loading a division, assuming that no equipment is available at the installation.

e. Loading Time—(Zone of Interior.) Passenger trains require 1 hour for loading. Baggage cars for personal baggage and baggage cars used for kitchen purposes will be spotted in advance. The time required to load troop units with all vehicles and equipment on freight trains or mixed trains varies with the training status of the unit and the conditions at the loading point. Use 6 hours for planning.

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30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
360	372	384	396	408	420	432	444	456	468	480	492	504	516	528	540	552	564	576	588	600

RAILWAY
CAR LOADING
SCALE (1/4"=1')

Inches	
109 1/4-ton trailer	
133 1/4-ton truck	
146 1-ton trailer	
177 3/4-ton weapons carrier w/winch	
225 1 1/2-ton truck 6 x 6 w/winch	
239 M4A4 medium tank	
265 2 1/2-ton truck LWB, w/winch	

VEHICLE AND EQUIPMENT
LOADING SCALE (¼ in.=1 ft.)
Lengths and widths shown are for
illustration only.

scaled to indicate the shipping lengths of various types of vehicles and equipment assigned to a given unit. By applying scale 2 to scale 1, various combinations may easily be developed which will result in the maximum utilization of railway equipment.

* Scale No. 2 is constructed on the same basis ($\frac{1}{4}$ inch equals 1 foot) and is specially

Infantry Division ^{1 2 3 4}

[illegible]

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[illegible]

¹ Can be adapted to any type unit.

* This tentative table should be maintained currently by division transportation officers in compliance with paragraph 12, AR 55-130. Subordinate and separate units should maintain similar tables.

³ Upon receipt of movement order, the table will be revised to reflect actual strength and equipment on hand and to conform to provisions of the movement order.

⁴ Organizational equipment and checkable baggage must be listed separately.

^b Includes attached medical and chaplains.

210. Train Consist Table

Train No.	Transportation groupings	Railway equipment							Train officers
		Coach	Pullman		Kitchen or kitchen-baggage	Box	Flat and gondola	Total	
			Standard	Tourist					
1-----									CO----- Mess O----- Surg-----
2-----									CO----- Mess O----- Surg-----
3-----									CO-----

NOTES

1. Upon receipt of movement order commanding general will designate the order in which units will be forwarded.
2. Train consist table is prepared by division transportation officer from data appearing on revised rail movement table.
3. Maximum and minimum length of trains (total number of freight and passenger cars) will be prescribed by the origin railroad (par. 1, AR 55-145).

4. Under "transportation groupings" show units which will comprise each individual train.
5. Under "train officers" show by name the officers assigned to each train in accordance with paragraphs 14, 15, and 16, AR 55-145.

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Suggested Symbols for Equipment and Vehicles

Equipment	Sym- bol	Equipment	Sym- bol	Equipment	Sym- bol	Equipment	Sym- bol
Ooach.....	OH	Box.....	BX	Gun, 37-mm, A.T....	OAT	-----	-----
Pullman, standard..	SP	Truck, ¼-ton.....	TJ	Howitzer, 105-mm....	HL	-----	-----
Pullman, tourist....	TP	Trailer, ¼-ton.....	TQ	Howitzer, 155-mm....	HM	-----	-----
Troop sleeper.....	TS	Truck, 2½-ton.....	TO			-----	-----
Kitchen car.....	K	Motorcycle.....	MO			-----	-----
Kitchen-baggage....	KB					-----	-----

Assignment of Units to Cars (By Block Numbers Above)

Unit	Block Nos.	Unit	Block Nos.	Unit	Block Nos.

NOTES

1. This plan is prepared by the division transportation officer. Copies should be furnished to—
 - a. Troop commanders.
 - b. Entraining officers.
 - c. Troop movement commander.
 - d. Motor park dispatcher so that vehicles will arrive at entraining point in the order in which they will be loaded on railway cars.
 - e. Local transportation officer.
2. In each block, indicate by symbol the specific personnel and equipment assigned to each car.
3. In each block representing an open-top freight car (flat car or gondola car) indicate by symbol the equipment specifically assigned to each car.
4. In the space provided at the bottom of the plan, all cars (freight and passenger) should be assigned by block numbers (not by railroad car initials and numbers) to the specific units, which will occupy them.

Section VI. HIGHWAY TRANSPORT

213. Definitions, as Applied to Highway Transport Operations

a. Line Haul. A type of haul where the distance is such that the proportion of running time is high in relation to the time consumed in loading and unloading. Usually expressed in terms of ton-miles forward per day.

b. Local Haul. A type of haul where the proportion of time consumed in loading and unloading is high in relation to running time. Usually expressed in terms of tons forward per day. Beach and port clearance hauls are local hauls involving the movement of cargo arriving at ports and beaches from ships, landing craft, or amphibious vehicles to inland dumps, depots, supply points, or railheads.

c. Vehicle Availability. The number or percentage of vehicles in a unit that can be operated at a given time.

d. Rate of March. Average number of miles traveled in any given period of time, including short periodic halts, expressed as miles in the hour.

e. Operating Time. Number of operational hours per day.

214. Planning Factors

a. In estimating truck company requirements for advance planning, the following basic facts must be considered:

- (1) Amount and type of cargo to be hauled daily.
- (2) Average pay load per vehicle.
- (3) Vehicle availability.
- (4) Distance cargo is to be hauled.
- (5) Rate of march.
- (6) Loading and unloading time.
- (7) Operating time.
- (8) Highway capabilities.

b. In the absence of specific information, the following values may be assumed for advance planning factors:

Factors	Type of equipment	
	2½-ton 6 x 6 trucks	10-ton semitrailer
Average pay load (highway use).....	4 tons.....	8 tons.
Vehicle availability.....	45 per co.....	45 per co.
Average rate of movement (allowing for rests, halts, refueling, etc.).	10 mi in hr.....	10 mi in hr.
Loading and unloading time (the total elapsed time between arrival and departure from loading or unloading point).	2½ hours.....	2½ hours.
Operating time (2-shift).....	20 hours.....	20 hours.
Average one-way distance of local hauls (includes port and beach clearance, intradepot moves, etc.).	12.5 miles.....	12.5 miles.
Average daily mileage capability for line haul.....	175 miles.....	175 miles.

215. Evaluation of Planning Factors

Consideration must be given in all cases to conditions which may affect highway transport operations, and each planning factor must be evaluated accordingly.

a. Average vehicle payloads will vary with the type and condition of equipment, the condition of highways and terrain over which vehicles will operate, and the type and density of cargo.

b. Vehicle availability will vary with the condition of equipment, adequacy of maintenance facilities, proficiency of personnel, and supply of spare parts and replacements.

c. Rate of march will vary with the type and condition of equipment, the condition and maintenance of highways (including the cumulative effect of bridges, fords, steep grades, sharp curves, tunnels,

and other restrictions to traffic), and extent of other traffic on roads. Allowances must be made in estimating rate of march for rests, halts, refueling, etc.

d. Loading and unloading time will vary with the number and proficiency of laborers, availability and adequacy of materials handling equipment and facilities, and with the type of equipment utilized, and the size, bulk, or type of cargo.

e. Operating time, for sustained operations, is normally based on two shifts of 10 hours each, which allows time for daily driver or unit maintenance and service. Where conditions require other than a 20-hour operating schedule, proper substitution in the basic formula will reflect the truck company requirements.

f. All of the above mentioned factors may be affected individually or collectively by other considerations, such as:

- (1) Seasonal and climatic conditions.
- (2) Enemy interference, or other tactical conditions.
- (3) Other traffic, including tactical, administrative, and indigenous vehicles; and foot troops and refugees.

216. Truck Company Requirements

a. Having determined or assumed values for the above factors, the truck company requirements for any type of sustained operation may be estimated by the use of the following formula:

$$\text{companies required} = \frac{\text{daily tonnage} \times \text{operating turn-around}}{\text{payload} \times \text{availability} \times \text{operating day}}$$

In the above formula "operating turn-around" is computed as follows:

$$\text{operating turn-around} = \frac{\text{round trip mileage}}{\text{rate of march}} + \text{loading and unloading time}$$

(If the number of trucks is desired instead of the number of truck companies, omit the "availability" factor in the basic formula.)

b. If it is desired to determine the number of truck companies required to move a given tonnage of cargo in one lift, the method of computation is—

$$\text{companies required} = \frac{\text{total tonnage}}{\text{Payload} \times \text{availability}}$$

(Again, if the number of trucks is desired instead of truck companies, omit the "availability" factor from the formula.)

c. *Examples*—(Using planning factors given in paragraphs 214 and 217.)

- (1) Estimate the number of truck companies required for a 16-mile haul of 5,000 short tons of dry cargo daily; using 2½-ton, 6 x 6, trucks.

$$\text{operating turn-around: } \frac{32}{10} + 2.5 = 5.7 \text{ hours}$$

$$\text{requirements: } \frac{5,000 \times 5.7}{4 \times 45 \times 20} = 8 \text{ companies}$$

- (2) Estimate the number of truck companies required to haul 3,000 short tons per day of dry cargo 180 miles, using 10-ton semitrailers.

$$\text{operating turn-around: } \frac{360}{10} + 2.5 = 38.5 \text{ hours}$$

$$\text{requirements: } \frac{3,000 \times 38.5}{8 \times 45 \times 20} = 16 \text{ companies}$$

- (3) Estimate the number of 2½-ton, 6 x 6, trucks required to haul 700 tons in one lift.

$$\text{requirements: } \frac{700}{4} = 175 \text{ trucks}$$

(The above formulas may be used to compute requirements for hauling bulk liquid by substituting daily gallons for daily tonnage and payload in gallons instead of short tons.)

217. Vehicle Payload Capacities

Type of equipment	Off-road	Highway average (see par. 219)	Maximum	Men and equip- ment*
Truck, cargo, ¼-ton, 4 x 4.....	¼-ton.....	¼-ton.....	¼-ton.....	2
Automobile, light, 5 passenger.....				5
Truck, pickup, 1-ton, 4 x 4.....	¾-ton.....	1-ton.....	2-ton.....	9
Truck, cargo, 2½-ton, 6 x 6.....	2½-ton.....	4-ton.....	5-ton.....	20
Truck, 5-ton, 4 x 2, S & P.....		5-ton.....	7½-ton.....	**33
Truck, 10-ton, 6 x 4, S & P.....		10-ton.....	12½-ton.....	**35
Bus, convertible, 37 passenger.....		5-ton.....	5-ton.....	37
Semitrailer, 10-ton, 26' S & P.....		8-ton.....	10-ton.....	**51
Semitrailer, van, 10-ton, 26'.....		8-ton.....	10-ton.....	**50
Semitrailer, 20-ton, 34' S & P.....		18-ton.....	20-ton.....	**67
Semitrailer, van, 20-ton, 34'.....		18-ton.....	20-ton.....	**66
Semitrailer, 12½-ton, 40' C2.....		12½-ton.....	12½-ton.....	
Semitrailer, 25-ton, lowbed.....		20-ton.....	25-ton.....	
Semitrailer, 60-ton, lowbed.....		40-ton.....	60-ton.....	
Semitrailer, 5,000 gal. gas tank.....		5,000 gals.....	5,000 gals.....	
Semitrailer, refrigerator, 7½-ton, lgt wgt.....		7½-ton.....	7½-ton.....	

*Does not include driver or assistant.

**Recommended for emergency use only.

218. Highway Tonnage Capabilities

a. In selecting the routes over which cargo is to be hauled, consideration must be given to the ability of the roads and bridges to sustain the operation. The gross weight of the heaviest loaded vehicle should not exceed the rated tonnage capacity of the weakest bridge, unless it is determined that such bridge or bridges will be strengthened. It is difficult to determine the exact tonnage capabilities of highways for sustained operations because of the number of varying conditions which prevail. Also, the volume of tactical, administrative, and indigenous traffic to be accommodated on supply routes may exceed the number of cargo hauling vehicles, which further restricts the capabilities of highway transport.

b. The following table may be used as a guide in estimating the tonnage capabilities of highways under average conditions, assuming operations are sustained, adequate road maintenance is provided, and each road bears two-way traffic.

Highway type	Short tons per day
Unimproved.....	200
Gravel.....	1,000
Soil bound gravel or stone base, bituminous treated.....	2,500
Bituminous surfaced macadam.....	4,000
High type asphaltic or concrete pavement.....	8,000

NOTE

The above capabilities may be exceeded up to 50 percent for other than sustained operations; however, the surface or pavement may be damaged to the extent that heavy maintenance will be required before sustained operations may be resumed.

c. Planned tonnage movement should not exceed the capability of any portion of the road net to be used, unless reconstruction or heavy maintenance is provided to increase the capability of the section of highway or bridge to meet the demands. Otherwise, alternate routes must be selected to distribute the load. If no alternate route is available and the indicated tonnage is not reduced, the highway or bridge can be expected to deteriorate rapidly and disrupt any sustained operation. (It should be kept in mind that maintenance vehicles and personnel on a road may also interfere with the flow of traffic and thereby limit capability.)

219. Division Trucks

In the forward area, it is normal to assume that roads are rough; therefore, in planning, trucks carry their rated loads only. When divisional trucks are used over good roads or in supply missions in the rear of the division zone, loads not to exceed 5 tons total for a 2½-ton truck, with or without trailer, may be used. Division trucks

are not organized and equipped for continuous round-the-clock hauling; when they are called upon for limited 24-hour-per-day operation, it is essential that extra drivers and supervision be furnished. Use the availability indicated in paragraph 214.

220. Armored Division Trains

a. Each combat battalion of the armored division has sufficient trucks in its unit trains to support the battalion for a distance of about 35 miles from army supply points or other source of supply. The actual distance capability in any operation depends upon conditions of the roads and vehicles and the ability of the enemy to interfere with friendly supply movements.

b. In addition to the unit trains, the quartermaster battalion contains six truck platoons, equivalent to two transportation truck companies. These vehicles, in addition to their usual class I, II, and IV supply missions, may be used to extend the reach of the entire division by bringing up gasoline and ammunition from army supply points to the division trains' area, where unit trains can pick up their loads. The exact distance which these division trains can accomplish depends upon the daily tonnage requirements; an average situation would provide an effective forward move of 25 to 30 miles.

221. Infantry Division Trains

a. The unit trains of infantry and field artillery elements of the infantry division do not have sufficient vehicles to be self-supporting except when supplies are available close to the division zone. Armored elements of the infantry division have organic truck support similar to that outlined in paragraph 220. All elements of the division are capable of transporting their loads of ammunition for limited operations.

b. The division quartermaster company consists of 48 general cargo trucks, 2½ ton, 6 x 6. These trucks are used to bring up rations and class II and IV supplies. They also maintain a supply of gasoline to assist those elements of the division which do not have organic fuel and lubricant trucks. The ammunition trains of all combat elements need help from the quartermaster trucks whenever expenditures are heavy.

c. By a combination of unit trains and division trains, the infantry division can support itself at an average distance of about 35 to 40 miles from army supply points.

Section VII. HELICOPTERS

222. General

Cargo helicopters are employed to move personnel, cargo, and equipment within the combat zone. They are somewhat limited in speed and range as compared to other types of aircraft; however, their ability to land and take off vertically makes them ideal for operation in and out of small, unprepared areas. Their ability to fly slowly permits continued operation under conditions of weather and visibility which would normally ground other aircraft. Normal missions of cargo helicopters are the movement of critical supplies, fragile items, and equipment to combat units; tactical displacement of troops; and missions involving movement to areas which are inaccessible to other means of transport.

Performance standards are affected by many variables: range, altitude, weather, aircraft performance, and pilot proficiency. The weight-lifting capability of a helicopter is greatly dependent upon air density. As density decreases, lift capability decreases. Normally wind will not materially affect operation. However, when long range flights are conducted or when operations are undertaken where the airborne load approaches the maximum capability of the helicopter, wind becomes a critical factor. High wind velocity (40 knots or greater) and gusty wind conditions may require the use of alternate plans or temporary interruption of helicopter service.

223. Helicopter Characteristics and Capabilities

Aircraft			Overall dimensions				Cargo door		Floor above ground	Cargo compartment						Fuel				
Model	Crew		Fuselage length	Width	Height (overall)	Rotor diameter	Dimensions	Location		Length	Width	Depth	Troop seats	Litter capacity	Cargo space (cubic feet)	Load for normal ops (lbs)*	Average consumption per hour (lbs)	Normal useful tank capacity (lbs)	Maximum range (NM)	
	Summer	Winter																	W/o load	Loaded (Max. Gross)
H-19C	1	2	41'3"	11'6"	13'4"	53'-----	48" x 48"	Right	2'2"	10'	5'6"	6'	10	6	330	440	240	1100	344	253
H-21C	2	2	52'6"	14'6"	16'	23 blade, 44' rotors each.	61" x 46"	Left	4'	20'	5'8"	5'6"	20	12	615	1240	677	1800	400	234

*Normal operations=130 hours of fuel plus 20 minutes reserve (short haul work).

Aircraft speed ¹ (knots)			Weights						Rescue hoist capacity ²
Model	Without pay load	Loaded (max. gross)	Empty (dry) (lbs)	Maximum allowable gross weight at sea level (lbs)	Internal payload ³ (pounds)		External payload ³ (pounds)		
					Summer	Winter	Summer	Winter	
H-19C	80	60	4,895	7,500	1,200	1,400	800	1,000	1 person.
H-21C	101	88	8,479	14,500	2,980	3,480	2,000	2,500	1 person.

¹ Speed figures are based upon no wind condition.

² Rescue hoist equipment to be installed on 1 out of every 5 aircraft, and is not to be used as cargo hoist.

³ Based on normal operating fuel load. (See note 1.)

224. Planning Factors

a. Availability. The number of helicopters available for a mission at any one time will depend upon the status of maintenance and inspections on the helicopters in the unit. Experience indicates that about two-thirds of the helicopters assigned to a unit are available for flying during continuous operations.

b. Types of Cargo. The dimensions of packages are restricted only by the size of the cargo compartment doors and/or the net which can be used to carry the cargo externally—assuming, of course, that the weight of the package(s) does not exceed the weight limitations for the aircraft under prevailing conditions. Typical items of cargo for internal loading are boxes of rations, ammunition, signal equipment, vehicle and aircraft parts and supplies, etc. Loads too large to fit into the cargo compartment but under the maximum weight permissible may be carried in a large cargo net slung under the helicopter. The maximum safe external load carried by a helicopter is considered to be two-thirds of the weight which can be carried internally under the same flight conditions.

c. Landing Facilities. The development of a landing site is a continuous operation, but provision must be made for an adequate site when originally planning helicopter movements. The minimum requirement for landing sites is as follows:

H-19—30 yards x 30 yards

H-21—30 yards x 50 yards

d. Maintenance. Maintenance facilities must be provided at all base landing sites, the minimum requirement being a sheltered area which will provide adequate shelter for organizational maintenance on the helicopters. For planning purposes 4-5 maintenance man-hours per flying hour may be considered average for the H-19 and 8-10 hours for the H-21.

e. Hours of Operation. The average number of hours of operation per day for continuous operations should not exceed 4 hours per helicopter.

f. Loading or Unloading Time.

Personnel.

Troops..... 3 minutes.

Casualties..... 10 minutes.

Cargo.

Internal in fuselage..... 5 minutes.

Suspended beneath helicopter..... 30 seconds.

Section VIII. MISCELLANEOUS TRANSPORT MODES

225. General

There are other modes of transportation which are relatively less important than pipeline, water, rail, highway, and air transportation in the overall picture of transportation, but all have peculiar characteristics which are adaptable to special situations as indicated in paragraphs 226-229. For this reason, planners should not underestimate their value.

226. Cableways and Tramways

Type	Employment	Maximum length (ft)	Capacity each (lbs)	Speed
Engineer medium cableway.	Transports material and personnel over a single ravine, gorge, or gully.....	1,200.....	3,000.....	550 feet per minute.
Engineer light aerial tramway, M2.	Transports material and personnel over slopes up to 35° from the horizontal and spans streams and ravines that lie across its route.	3,000.....	350.....	400 feet per minute.
Engineer light pioneer aerial tramway and cableway, M1.	Transports material and personnel over terrain inaccessible or difficult for other means of transportation. Can be used as a cableway to cross a single ravine, gorge, or gully; as a tramway to traverse slopes up to 35° from the horizontal; or as a toboggan hauling unit for operation on snow or smooth ground.	Tramway, 2,000; cableway 1,500.	Tramway, 350; cableway and toboggan, 2,000.	Tramway, 310 feet per minute; cable- way and toboggan, 580 feet per minute.

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227. Pack Animals

(Mule)

a. Employment. Pack mules may be employed to transport light cargo over terrain which is impassable for motor transport.

b. Capabilities.

- (1) Cargo load—200–250 pounds.
- (2) Movement of casualties—1 litter or 2 sitting casualties.
- (3) Rate of march—2 to 3½ miles in the hour.
- (4) Average daily distance:
Mountainous terrain—15 miles.
Rolling or flat terrain—20 miles.
- (5) Gradeability:
Rate of ascent—1,650 vertical feet per hour.
Rate of descent—1,000 vertical feet per hour.
- (6) Noneffective rate—32 per 1,000 mules.

228. Sled Trains

a. General. The mission of the sled train is to furnish over-snow transportation for supplies and equipment in support of operations where ordinary methods of transportation are impracticable.

b. Planning Factors.

- (1) Composition of sled trains—for planning purposes the ideal load for tractors, based upon their drawbar horsepower, allowing sufficient reserve power is as follows:

Class ¹	Loaded 10-ton sleds	Wani- gan ²
91-140.....	6	1
61-90 ³	4	1
46-60.....	3	1
36-45 ⁴	2	1

¹ Indicates drawbar horsepower.

² Shelter on sled for crew.

³ Tractors in the 61-90 class can pull 4 sleds over rough terrain, 6 sleds over level terrain, and 8 or 10 sleds on level ice 30 inches thick. Up to 12 sleds can be pulled by this class if starting assistance is provided.

⁴ Tractors in the 36-45 class can pull 6 loaded sleds on level ice, but the assistance of another tractor is required to start the load.

- (2) Lift capacity, sled, cargo, 10-ton:
Average—9 short tons. Maximum—12 short tons.
- (3) Miles in the day (20-hour operation)—40.

229. Human Bearers

a. General. Human bearers consist of natives or other personnel used for the transportation of personnel and/or supplies. Their use

is generally limited to those situations where other modes are impractical or not available.

b. Planning Data. For planning purposes, the following may be assumed:

- (1) *Cargo loads.*
 - (a) Male bearers—40 pounds average load.
 - (b) Female bearers—30-35 pounds average load.
- (2) Personnel loads—8-12 bearers per litter team (for continuous operation).
- (3) Rate of march—15 miles in the day under average conditions.
- (4) Noneffective rate—approximately 30 percent.

Section IX. TERMINALS

230. General

a. Types. A terminal is either end of a carrier line, such as a railroad, trucking line, shipping line, or air line. It normally includes servicing, repair, and maintenance facilities; classification yards; dock and lighterage facilities; management offices; storage facilities; and freight and passenger loading and unloading facilities, as required. The four types of terminals treated in this section are—

- (1) Ports.
- (2) Beaches.
- (3) Inland terminals.
- (4) Aerial ports.

b. Elements of Terminal Planning. There are normally five steps in terminal planning:

- (1) *Step 1.* Computation of the terminal work load required to support the operation, expressed as cargo tonnage and number of personnel per day.
- (2) *Step 2.* Estimation of the existing terminal capacity, which is the total tonnage and personnel that can be *received, processed, and cleared* through the terminal in a day.
- (3) *Step 3.* Estimation of construction requirements, which are the requirements for repair and rehabilitation of existing facilities and construction of new facilities necessary to increase the existing terminal capacity to equal the required terminal work load.
- (4) *Step 4.* Estimation of the equipment requirement, which is the amount of equipment needed to process the required work load through the terminal with the maximum efficiency.

- (5) *Step 5.* Estimation of the personnel requirements, which are the units and individuals needed for administration and operation in processing the required work load through the terminal.

231. Ports

a. General. This paragraph deals with planning data for ports in the hands of the enemy, but which are to be opened for operation as soon as cleared. For this reason, data are based on the employment of Army personnel and ships' gear only for the unloading of ships. Appropriate allowances should be made for other circumstances such as availability of civilian labor and port cranes. Ship discharge will be accomplished by one of two methods—either from vessels alongside a wharf onto the wharf, or by lighters from a vessel anchored astream. Throughout the discussion of ports in this paragraph, the basic period of time is a 20-hour day. This is generally considered to be a complete round-the-clock working day in port operations, the other 4 hours of the day being taken up in delays inherent in the work such as breakdowns, waiting for trucks, changing shifts, and meals. (For planning of port discharge in forward areas when enemy action may be expected to cause work delays, 15 hours working time per day may be estimated. Factors used may be reduced proportionately.) For general planning purposes, the transportation port company is considered capable of discharging 720 short tons per 20-hour working day.

b. Port Capacity Estimation.

- (1) *Factors.* Port through-put capacity is determined by three major factors. In all instances, one of these will be the limiting and thereby determining factor. Each of the three factors may be expressed in terms of short tons per day for planning and estimating purposes. All three factors should be accurately estimated even though the limiting factor may be obvious. These estimates will serve to indicate the facilities where improvement effort will yield the greatest return in terms of tonnage movement capability. The three major factors are—
 - (a) The ability to move ships into the harbor or coastal area of the port, that is, port reception capacity.
 - (b) The ability to accommodate ships in the harbor and to discharge them, that is port discharge capacity.
 - (c) The ability to accomplish port clearance, that is, port clearance capacity.
- (2) *Checklist for port capacity estimation.*

*Collect and evaluate these data**Compute these factors**Determine this figure*

1. Channel depths-----
2. Obstructions-----
3. Enemy air activity---
4. Enemy surface activity.
5. Enemy submarine activity.
6. Climate-----
7. Weather-----
8. Mine fields or contaminated areas.
9. Our own capabilities in combating obstacles.
1. Tactical dispersion requirements.
2. Wharf facilities-----
3. Beach capabilities----
4. Discharge rates ashore.
5. Discharge rates astream.
6. Anchorage area-----
7. Extent of destruction or contamination.
8. Climate and seasons--
9. Weather and tide characteristics.
10. Cargo-handling equipment available.
11. Floating craft and equipment available.
12. Transit sheds and areas.
13. Availability of indigenous labor.
14. Space reserved for local economy.
15. Enemy activity-----
1. Capacity of rail facilities.
2. Capacity of highway facilities.
3. Capacity of inland waterway facilities.
4. Capacity of pipeline facilities.
5. Capacity of air facilities.
6. Enemy activity-----

(a) Evaluate to determine: A. Port reception capacity.

(b) Evaluate to determine: B. Port discharge (input) capacity.

(c) Add to determine: C. Port clearance (output) capacity.

Port throughput capacity.

- (a) These data will probably be obtained from Navy sources; also see paragraphs 240 through 249.
- (b) For information on beaches see paragraphs 232 through 233.
- (c) Capabilities of transport services—pipeline, inland waterway, rail, highway, air transport—are shown in paragraphs 184 through 199, 213 through 221, and 235 through 239.

c. *Wharf Facilities.*

- (1) *General.* Since only two methods of ship discharge are available (*a* above), general planning must consider wharf facilities for alongside and lighter discharge. The Victory type ship having five hatches is used as a basis for all discharge. It was selected since it so closely meets the average characteristics of a nominal ship. Deep-draft wharfage must be provided wherever *alongside* discharge is contemplated. Shallow draft wharfage and anchorage areas must be given joint consideration when lighter discharge is contemplated. Factors governing wharfage will be found in (2) and (3) below.
- (2) *Deep-draft wharf requirements.* A wharf is classified as deep-draft when the water alongside is deep enough to permit a fully loaded ship to tie up alongside. The following criteria will govern:
 - (a) *Water depth.* Water depth should be not less than 30 feet at low tide. A minimum of 30 feet is used for planning purposes since this will accommodate virtually all deep-draft vessels.
 - (b) *Length for Victory type ship, 500-feet.* Each hatch (5 per vessel) will require 100 feet of wharf. When wharfs are over 500 feet long and less than the next higher 500-foot unit, the odd footage is disregarded in determining the number of berths available (that is, 1,200 ft will accommodate only two ships at the same time). However, the extra 200 feet can be considered for lighterage use (3) below.
 - (c) *Width.* Width should be 60 to 90 feet for discharge on one side of wharf only; 90 feet and up for discharge on both sides of wharf. For planning and estimating purposes, a wharf should be 60 to 90 feet wide to allow sufficient working space to discharge cargo from a ship. In the case of a pier where two vessels can tie up at the same time, one on each side, it is recommended that the width be 90 feet or more for efficient discharge.

(3) *Lighterage wharf requirements.*

(a) *General.* Any wharf may be used for lighter discharge. It may include wharfage that dries out at low tide but which can be used half the time or 10 hours per day.

(b) *Length for lighter.* Wharfage length for a lighter should be 100 feet. Length of wharfage over 100 feet and less than the next higher 100-foot unit is disregarded (that is, a 350-foot wharf will handle three lighters at the same time).

(c) *Width.* A minimum of 35 feet is recommended for discharge on one side—42 feet for discharge on both sides of pier.

d. *Discharge Rates.*

(1) *From ship (Victory type).* Seven hundred and twenty short tons per 20-hour day (five hatches at 7.2 short tons per hour).

(2) *From lighter alongside, direct onto wharf.* One hundred and eighty short tons per 20-hour day (1.8 short tons per linear foot of wharf per 20-hour day).

e. *Anchorage Areas.* Anchorage areas are defined as shelter areas inside or near a harbor, unaffected by swell, where ships may anchor and discharge by lighter.

(1) *Depth.* Minimum, 30 feet; maximum 210 feet. The minimum depth is dictated by the draft of the ship, and the maximum by the length and weight of the anchor chain.

(2) *Free swinging anchorage area.* Eight-hundred-foot-radius circle.

(3) *Moored bow and stern.* Variable; this method is not preferred since it can be used only in areas unaffected by tidal currents.

f. *Estimation of Port Operating Personnel and Equipment.*

(1) *General.* To insure maximum efficiency in port operations, a balanced operating force of general and special service units, supervisory elements, and suitable equipment must be available. Extreme care must be exercised during both the planning phase and actual operating phase to insure that a balance is established and maintained. The possibility of using civilian and prisoner-of-war labor should not be overlooked, particularly in later expansion of the port.

(2) *Operating personnel.* Operating personnel are divided into managing, or supervisory, elements (such as port headquarters units) and functional general and special service operating units. In this last category may be included port companies or battalions, general service companies, truck companies, engineer general and special service units, harbor

craft units, and such other service units particularly suited for the functioning of any particular port. Units commonly found in a port are listed below—

Headquarters and Headquarters Company, Transportation Terminal Command C (TOE 55-111).

Headquarters and Headquarters Company, Transportation Terminal Command B (TOE 55-121).

Headquarters and Headquarters Detachment, Transportation Terminal Battalion (TOE 55-116A).

Transportation Terminal Service Company (TOE 55-117A).

Quartermaster Service Company (TOE 10-67).

Headquarters and Headquarters Company, Transportation Truck Battalion (TOE 55-16A).

Transportation Light Truck Company (TOE 55-17).

Transportation Medium Truck Company (TOE 55-18).

Transportation Amphibious Truck Company (TOE 55-37).

Transportation Heavy Truck Company (TOE 55-28A).

Transportation Boat Company (TOE 55-5MA).

Transportation Base Depot Company (TOE 55-260A).

Transportation Service Organization—Team IE, Terminal Floating Craft Maintenance and Repair (TOE 55-500A).

Medical Service Organization—Teams MA-MB, General Dispensary (TOE 8-500A).

Finance Service Organization—Teams as required (TOE 14-500A).

Army Postal Unit, General Assignment—Type as required (TOE 12-605).

Signal Service Organization—Teams as required (TOE 11-500A).

Military Police Battalion (TOE 19-55A).

Engineering Service Organization—Teams HD-HG, Utilities and FA-FD, Firefighting (TOE 5-500A).

g. Special Cargo Handling Equipment. Requirements for general planning purposes, to handle 720 short tons of general cargo daily into an established terminal or beach operation, or to load 500 short tons of general cargo daily are as follows:

1	2	3	4	5	6	7	8
	Cranes	Lift Trucks			Conveyors	Stevedore gear sets	Lighters
		2,000 lb load	6,000 lb load rough terrain	10,000* lb load rough terrain			
Transportation.....	1-33½ ton.....	2	7	4	20 Sections (10ft.) and 5 curves.	5 ea Cargo set, general hatch 1 ea Spec Cargo Sets.	12 Lighters or 4 LCU; or 12 LCM.
Terminal service.....	2-10 ton.....						
Company.....	1-40 ton.....						
TOE 55-117A.....	2-20 ton.....						

*15,000 pounds rough terrain lift truck when available.

h. Operating Equipment. Equipment necessary for port operations can be separated into two categories:

- (1) *The first category*, equipment directly employed in ship discharge and cargo movements, includes such items as cranes, fork lift equipment, trucks, tractors, harbor craft, lighters, railway engines and cars.
- (2) *The second category*, equipment supporting the port operations, includes all maintenance utilities, power generators, repair shops.
- (3) For details of operation and capacity of port operating equipment, see the following references:

FM 55-110. Transportation Port Companies, Military Stevedoring.

FM 55-130. The Harbor Craft Company.

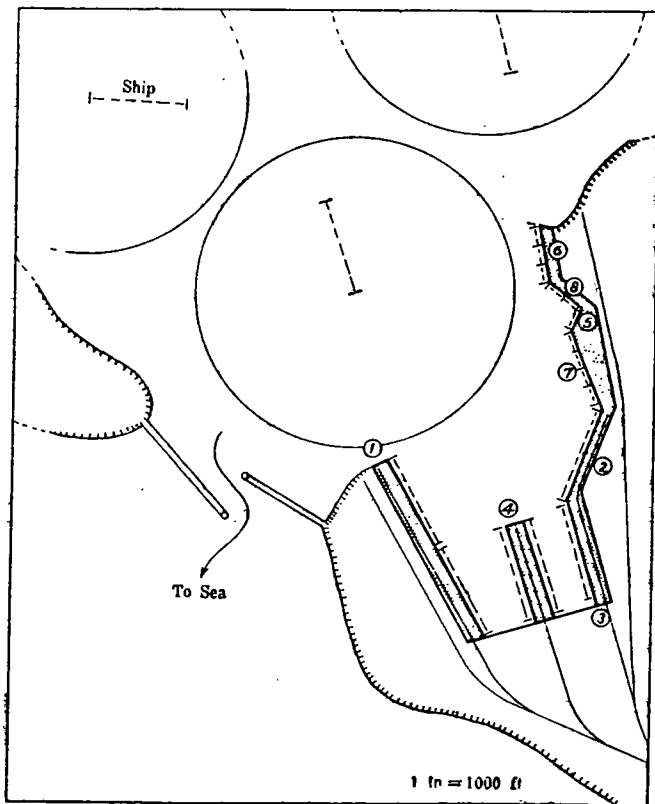
TM 55-370. Operation of Small Boats and Harbor Craft.

i. Illustrative Example of Port Capacity Estimation. The following example has been provided to demonstrate the recommended procedure for port capacity estimation based upon the steps and data outlined in the preceding paragraphs.

- (1) *Situation.* A true-scale chart of a certain harbor has been prepared for evaluation. With reference to this chart, the following additional information has been assembled:

1	2	3	4
Wharf No.	Length (feet)	Width (feet)	Minimum depth alongside at low tide (feet)
1.....	1,060	80	32.
2.....	490	60	30.
3.....	580	90	30.
4.....	535	100	34, each side.
5.....	125	54	8.
6.....	295	60	15.
7.....	450	75	22.
8.....	210	60	16.

- (a) There is sufficient area inside the harbor to anchor three ships as shown, where they can be worked continuously.
- (b) In good weather, as many as two vessels can be anchored and worked outside the breakwater.
- (c) Winds, swells, tides, and tidal currents present an unusual problem.
- (2) *Problem.* To estimate the daily capacity of this port during ideal weather.



(3) *Solution.*(a) *Discharge tonnage at deep-draft wharfage.*

1	2	3
Wharf No.	Vessels which can be berthed	Rate of discharge in short tons per day
1.....	2 Victorys.....	$2 \times 720 = 1440$.
2.....	1 Victory.....	$1 \times 720 = 720$.
3.....	1 Victory.....	$1 \times 720 = 720$.
4.....	2 Victorys.....	$2 \times 720 = 1440$.
Total.....		4320.

(b) *Discharge tonnage to lighterage wharfs.*

1	2	3
Wharf No.	Lighters accommodated	Rate of discharge in short tons per day
5.....	1	$1 \times 180 = 180$.
6.....	3	$3 \times 180 = 540$.*
7.....	4	$4 \times 180 = 720$.
8.....	2	$2 \times 180 = 360$.
Total.....		1,800.

*The situation shows wharf 6 to be only 295 feet long. The criterion for lighter wharfage, as given in c above limits this wharf to 2 lighters. However, since the 5-foot shortage will limit operations to no appreciable extent, it is feasible to use the 95-foot section for docking a third lighter. This has been done here.

(c) *Rate of discharge from ships at anchor to lighters.* From the situation, three ships can be anchored inside the breakwater, and two can be anchored and worked outside the breakwater in good weather. Therefore, in good weather, cargo can be discharged from ships to lighters at the rate of $(3+2) \times 720 = 3,600$ short tons per day.

(d) *Resultant daily port capacity—summary.*

1. Discharged alongside deep-draft wharfs—4,320 short tons per day.
2. Discharged from lighters to wharf—1,800 short tons per day.
3. Transferred from ships to lighters—3,600 short tons per day.
4. Therefore: 1,800 short tons per day is maximum discharge by lighter since lighter wharfage is the limiting factor in this case.

5. Total daily port capacity:

4,320 short tons per day, alongside.

1,800 short tons per day, by lighter.

Total 6,120 short tons per day.

- (4) Advance study must be made to determine the probable effect of bad weather on rate of discharge and other factors in port capacity. Continuous records of daily discharge plotted against weather and surf conditions prove valuable in planning future discharge in the same and similar ports.

232. Beaches

a. Amphibious Operations.

- (1) *Beach capacity.* Each landing in an amphibious operation differs as to climatic and hydrographic conditions and variations in topographic features, as well as in the military situation. These variable factors make it impracticable to develop detailed logistical planning data applicable only to beaches and their capacity to receive troops and cargo. However, certain general planning data can be developed.

- (a) Beach capacity is an evaluation of cargo quantities that can be discharged over a given lineal beach length within a stated interval of time. During the initial phases of an amphibious operation, beach capacity will be limited to the beach (or beaches) over which the assault landing is made; later, if necessary, overall capacity may be increased by the consolidation of beaches for more efficient operation and for the opening up of sheltered unloading points in rivers or bays. Experience has indicated that, during the assault phase of an operation, cargo can be landed and moved across beaches as follows (use either 1 or 2, or use 1 and 2 together in proportionate combination):

1. Average short tons of cargo per day per mile of beach..... 3,000
(Average per 1,000 yds. of beach..... 1,680)
2. Average numbers of vehicles and personnel landed simultaneously per day per mile of beach:

Vehicles.....	675
Personnel.....	4,725

- (b) Amphibious operations of World War II followed a general phase relationship between assault and base development. Debarkation time and phases are not as readily distinguish-

able in large operations as in smaller forces. However, the pattern followed was generally the same, and is provided as general information.

Phase	Supplies involved	Elapsed time
Assault.....	Organic equipment and assault combat carried supplies.....	D-day to D+15.
Buildup ¹	Organic equipment, assault combat carried supplies, maintenance, and buildup (reserve).	D+15 to D+180.
Maintenance ²	Maintenance.....	After D+180.

¹ During this phase, port construction will be started and limited port operation will be initiated.

² Ports should be in operation by D+60.

(2) *Ship-to-shore supply service.* A ship-to-shore supply service will include the following:

- (a) Unloading cargo from ships into landing craft or landing vehicles.
- (b) Movement of cargo by landing craft or landing vehicles from ships to shore.
- (c) Unloading of landing craft at beaches.
- (d) Movement of cargo from beaches to beach dumps, transfer points ashore, and shore-based dumps.
- (e) Unloading at dumps or transfer points.

(3) *Requirements for ship unloading.* Facilities for unloading ships anchored astream usually are limited to ships' organic gear. Using organic gear, ships normally can discharge cargo into special landing equipment faster than beaches can receive and clear the loaded landing craft and vehicles.

(4) *Characteristics of amphibious force vessels and craft.*

- (a) Data contained in this paragraph with reference to speed and endurance may vary under operational conditions.
- (b) Designating letters and names are used in the following general manner:

1. LC (landing craft) is applied to nonocean-going vessels of less than 200 feet overall length designed for landing operations.
2. LS (landing ship) is applied to ocean-going vessels of more than 200 feet overall length and designed for participation in landing operations.
3. LV (landing vehicle) is applied to small units designed for landing operations and capable of use on land or water.

(c) *Characteristics of small landing craft.*

Name	Symbol	Length	Beam	Capacity		Draft (loaded)		Speed (knots)	Range (miles)	Crow	Weight (tons) empty	Example of material carried
				Troop	Cargo (tons)	Forward	Aft					
Landing craft, vehicle-personnel....	LCVP	35'0"	10'11½"	36 or 4.05.....			3'0"	9.....	102	3	9.35	1¼-ton truck and 1¼-ton trailer.
Landing craft, mechanized (mark 3)...	LCM (3)	50'0"	14'1"	100 or 30.....		3'8"	4'8"	11.....	850 at 6¼ knots.	4	26	1 30-ton tank, or 1 2½-ton truck and 1 1-ton trailer.
Landing craft, mechanized (mark 6)...	LCM (6)	58'0"	14'1"	120 or 34.....		3'8"	4'8"	11.....	850 at 6¼ knots.	4	29.5	1 35-ton tank or 1 2½-ton truck and 1 1-ton trailer.

(d) *Characteristics of amphibious vehicles.*

Landing vehicle, tracked (mark 3)...	LVT (3)	24'1"	11'10"	24 or 4.....	No consideration need be made for the draft of amphibious vehicles.	1 18L.....	1 150L.....	3-4	14	4 tons, bulk cargo. 105-mm howitzer.
Landing vehicle, tracked (mark 4)...	LVT (4)	26'1"	10'8"	24 or 4.....		1 4W.....	1 75W.....			
Landing vehicle, tracked (Armored) (mark 4)...	LVT (A) (4)	28'1"	10'8"	.....		1 15L.....	1 150L.....	3-4	13.7	1¼-ton truck.
Landing vehicle, tracked (Armored) (mark 5)...	LVT (A) (5)	28'1"	10'8"	.....		1 5.5W.....	1 60W.....			
Truck, 2½-ton, 6 x 6 amphibious....	AMPH TRK	31'0"	9'9"	25 or 2.5.....		1 15L.....	1 150L.....	5	17.5	None.
						1 5.2W.....	1 75W.....			
						1 50L.....	1 240L.....	2	7.5	1 105-mm howitzer.
						1 5.5W.....	1 35W.....			

1 Possible maximum, 30-36.

2 L=land. Speed in mph.

3 W=water. Speed in knots.

(e) Characteristics of landing ships.

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Name	No. ships in class	Class	Type	Troop capacity	Combat load (short tons)	Troop cargo (cu ft)	Troop cargo (sq ft)	LCM carried	LCVP carried	Length (overall)	Draft (ft)
LST:											
1,513,531.....		1	Elevator, 10-ton capacity.		500 tons.....	92,765.....	6,328, tk deck; 4,500, main deck.	0	2-6	328'	Landing—500 tons, 3'0" fwd, 9'6" aft. Oceangoing—1,431 tons, 8'0" fwd, 14'4" aft.
514-530, 532.....		542	Ramp, 17-ton capacity.	*167.....	Tank deck—17 LVT or 21 amph trk or 12 medium tk or 10 tk w/T6. Main deck—24 2½ ton trk or 44¼-ton trk.	92,765.....	6,328, tk deck; 4,500, main deck.	0	2-6	328'	Landing—500 tons, 3'0" fwd, 9'6" aft. Oceangoing—1,431 tons, 8'0" fwd, 14'4" aft.
1153-1154.....	2	1153	Ramp, 25-ton capacity (apprx.).	*197.....	Tank deck—21 LVT. Main deck—35 2½-ton trk.	100,900.....	8,072, tk deck; 6,268, main deck.	0	4	328'	Landing—560 tons, 3'8" fwd, 10'4" aft. Oceangoing—2,565 tons, 9'9" fwd, 16'1" aft.
LSM.....		1	Open well.....	*54.....	5 medium or 3 hv tk or 6 LVT or 9 amph trk or 165 tons cargo.	21,027 (open well).	3,186.....	0	0	203'6"	Landing—165 tons, 3'5" fwd, 7" aft. Oceangoing—387 tons, 4'5" fwd, 8' aft.
LCU(6).....			Open well.....	8; for short distances 400.	5-30 tons tk or 3-50 tons tk or 165 tons cargo (maximum beaching capacity).	10,974.....	1,829.....	0	0	120'4"	Landing—150 tons, 3'7" fwd, 4'2" aft.

*Troop capacity may be increased by berthing troops on cots.

NOTES

1. A hoat space is the spaco and weight allowed one soldier with his individual combat equipraent. It is 224 pounds or 13.5 cubic feet. When computing hoat spaces required for cargo, use either the weight or the space occupied, whichever is greater. Hand carts, loaded or empty, require two hoat spaces.

2. Running time may be computed from the formula $t = \frac{3d}{s}$ where
 d = distance run in bundreds of yards.
 s = speed in knots (1½ mpb).
 t = running time in minutes.

(f) Characteristics of transport type vessels.

Name	No. ships in class	Class	Type	Troop capacity	Combat load (short tons)	Troop cargo (cu ft)	Troop cargo (sq ft)	LCM carried	LCVP carried	Length (overall) (ft)	Draft (ft)
LSD: 11-22, 25, 26, 27-----	-----	-----	-----	332	(2)-----	Open well deck	16,691	-----	2	458	17
APD:											
1-36-----	-----	Manley	EX-DD	275	6¼-ton trk, 21-ton trk, 4 carts	9,000	-----	-----	4	314	12
37-139-----	-----	Bates	EX-DE	170	6-10 tons	9,000	-----	-----	4	306	13

¹ Ships of this class are now being fitted with a deck over the well deck for use in carriage of additional trucks or cargo. Helicopters can also land.

² (1) Well deck loaded: a. 3 LCU's fully loaded; or b. 18 LCM's (6) loaded; or

c. 27 LCVP or 41 LVT or 47 amphibious trucks. (2) Frequent load: 3 LCU each preloaded with tanks. (3) Draft loaded: a. Draft loaded—18'; b. Ballasted for discharge—29'.

- (5) *Cargo movement by amphibious trucks.* Amphibious trucks are specialized equipment of exceptional value in amphibious operations which enable direct movement of cargo from ships to shore-based dumps. Experience indicated that amphibious trucks are capable of movement of 720 short tons per company per day for overall in-and-out of water operations. This factor may be used for general planning purposes.
 - (6) *Equipment required for operations on the beach, for beach clearance, and for operations in shore-based dumps.* World War II experience consistently showed a lack of sufficient shore-based equipment to receive cargo as rapidly as unloading from ships could be effected. Resulting bottlenecks at beaches and at beach dumps could have been avoided had additional cargo-handling equipment, particularly cranes, been available. It was found that cargo-handling equipment best adapted to beach and shore dump employment were cranes, tractors, and trucks. Detailed characteristics of these items are outlined below.
 - (a) Cranes should be self-propelled, of medium and heavy types, with booms 40 feet in length to permit lifting filled cargo nets. Each crane can handle discharge from 3 LCU's, 8 LCM's, or 12 LCVP's under normal beach operations where sufficient trucks or tractors are available to haul or drag away unloaded cargo.
 - (b) Medium and heavy tractors, on an average, can tow two loaded sled pallets. This type movement from beach to dump is slow and less satisfactory than movement by truck. However, for dragging pallets from landing craft and within supply dumps, tractors are effective. Tractors are invaluable for clearing the beach and dump areas of mired vehicles. Eight to ten tractors per assault division, six to seven on beaches, and two to three in supply dumps, are usually sufficient. Several tractors assigned to a beach should be equipped with angledozers.
 - (c) See paragraphs 213 through 221 regarding trucks.
 - (7) *Beach service troop requirements.* Service troops are employed throughout the supply-service cycle from ship unloading to segregation and storage of supplies in shore-based dumps. The multiple functions performed in this cycle require both general and special service type units. Care must be exercised in balancing the type of troops employed, for a breakdown in service troops' functioning will render available equipment partially or completely ineffective.
- b. *Logistical-Over-The-Shore (LOTS) Operations.*

- (1) *General.* A LOTS operation provides, in situations other than amphibious operations, for the movement of cargo across the shore between ocean transportation and shoreside facilities. Beaches and other more difficult shore line will be utilized during this type of operation to the extent required by the situation.
- (2) *Beach capacity estimation.* The checklist contained in paragraph 231b(2) may be used to assist in determining the beach capacity. Certain of these factors are not primary considerations and others must be greatly expanded according to the location under study, which will determine the weight to be given each individual factor. The following items must be investigated thoroughly to determine their effect on the operation:
 - (a) Weather—wind, fog, rainfall, temperature.
 - (b) Sea area—extent, depth of water, type of bottom, vulnerability to sea wave action.
 - (c) Beach approaches—reefs, bars, man-made obstacles, tide, type of bottom, surf conditions, underwater gradient.
 - (d) Beach—gradient, composition, length, width, wave effect, exits.
 - (e) Hinterland—depth, concealment, transportation net capability.
- (3) *Operating equipment.* The same materials handling functions are performed as in a conventional port situation (par. 231b) but there is a greater requirement for cranes, and fork-lift trucks must be able to traverse sand and soft terrain. Amphibians should be used to relieve congestion at the water's edge and eliminate unnecessary handling of cargo.

233. Inland Terminals

a. Definition. Inland terminals are defined as those inland intransit points where cargo is—

- (1) Temporarily held intransit awaiting disposition instructions.
- (2) Transferred from one mode of transportation to another.
- (3) Broken down from bulk shipments and reshipped in small units.
- (4) Collected from other points to make a transportation unit for reshipment.

b. Capacity Estimation. Inland terminal capacity is the total tonnage that can be received, processed, and cleared through the terminal in any one day. The terminal capacity is estimated by analyzing three major factors—reception capacity, loading and unloading or transfer capacity, and clearance capacity—to ascertain which is the limiting factor, and then determining its value as expressed in daily tonnage. The following is a checklist for estimation of inland terminal capacity:

*Inland Terminal Capacity**Collect these data where applicable**Compute these factors**Determine*

1. Channel depths-----
2. Obstructions-----
3. Capacity of rail facilities.
4. Capacity of highway facilities.
5. Capacity of pipeline facilities.
6. Capacity of air facilities.
7. Enemy air activity-----
8. Enemy surface activity--
9. Climate-----
10. Weather-----
11. Contaminated areas----
12. Our own capabilities in combating obstacles.

- (1) Evaluate to determine:
A. Inland terminal reception capacity.

1. Tactical dispersion requirements.
2. Wharf and/or platform facilities.
3. Discharge rates-----
4. Unloading rates-----
5. Loading rates-----
6. Extent of destruction or contamination.
7. Climate and seasons----
8. Weather and tide characteristics.
9. Materials-handling equipment available.
10. Cargo-handling equipment available.
11. Floating craft and equipment available.
12. Airfield capabilities-----
13. Transit sheds, yards, and areas.
14. Indigenous labor available.
15. Space reserved for local economy.

- (2) Evaluate to determine:
B. Loading and/or unloading or transfer capacity.

Inland terminal capacity.

1. Capacity of rail facilities.
2. Capacity of highway facilities.
3. Capacity of inland waterway facilities.
4. Capacity of pipeline facilities.
5. Capacity of air facilities.

- (3) Add to determine:
C. Clearance capacity.

c. Estimation of Equipment. Equipment requirements are determined by analyzing the projected work load of the inland terminal in relation to the tonnages and types of cargo to be unloaded, loaded, and transferred. See paragraphs 231g and h for planning data on cargo handling equipment.

d. Estimation of Personnel Requirements. Personnel requirements are determined by evaluating the mission of the inland terminal in terms of work load, equipment to be manned, and services to be performed. To insure maximum efficiency in terminal operation, a balanced force of general special service units and supervisory elements must be available. The use of indigenous and prisoner of war labor should be considered.

234. Air Terminals

SR 96-105-1 charges the Air Force with the operations of air terminals. Army units may establish facilities and station personnel at Air Force air terminals in a tenant status to perform necessary Army functions and such other functions as agreed upon locally between the responsible Army and Air Force commanders concerned in each instance.

Aerial transport squadron (AF TO 1-1967, 1 Mar 53) is the Air Force unit designated to fulfill this function. The squadron is cellular in type. It will be utilized and its strength determined by the mission at hand. These units provide passenger and cargo handling capability to include manifesting, warehousing, off and on loading, tie-down, preparation for aerial delivery and ejection in flight.

Capabilities of one squadron:

- a. Handling 420 tons of cargo and/or personnel per 8-hour day in air landing operations.
- b. Rigging for airdrop and loading 280 tons of equipment per 8-hour day when packing of parachutes is not required.
- c. Rigging for airdrop, packing parachutes, and loading 112 tons per 8-hour day.
- d. Performing organizational maintenance on assigned vehicles.
- e. Providing pathfinder teams when augmented by part IIA, TO 1-1967.

Section X. FIXED WING TRANSPORT AIRCRAFT

235. General

- a. The movement of troops by air transport normally is ordered by the headquarters in command of both the transported and transporting units. These orders are issued simultaneously to the commander of the unit to be transported and to the commander of the transporting unit.

b. Troop movements by air are of two types: tactical and administrative. When the move is tactical, the loading plans will depend upon the tactical mission to be accomplished at the end of the move. An administrative move is merely a ferrying operation from one base to another. It is not feasible to prescribe standard tactical loads for the air transport of personnel and equipment because of the variable conditions surrounding each operation. For example, the loading plans will vary depending upon the mission, the aircraft available, the distance to be flown, the conditions of the flight, the security of the landing area, the time available for disassembly and assembly of equipment, the amount of supplies to be transported with the troops, the size of engineer tools needed in the terrain to be encountered, and other factors. For more technical data on the loading of transport aircraft, see TM 57-210.

c. The air movement of a large body of troops normally will involve concurrent departures from several airfields, and, in the objective area, concurrent landings at several terminal landing strips. The availability of transport aircraft and base facilities, the urgency of the situation, and the likelihood of hostile interference will be major factors which determine the number of installations employed, as well as the number of sorties to be made by the transporting aircraft. For considerations governing the employment of air transportation, see FM 100-5. For staff procedures, air movement tables and other forms relative to air movements, see FM 57-20, FM 57-30, and TM 57-210.

236. Airfield Capabilities

a. Improved airfields in rear of combat zones can serve as a base for approximately 2 wings. Under ideal conditions, aircraft land or take-off at 3-minute intervals, and 1 hour on the ground is required for each landing for necessary servicing, reloading, and inspection.

b. Unimproved airfields and landing strips in rear of the combat zone can serve as a base for approximately one wing.

c. Transport aircraft normally will not be based in the combat zone. On airfields in the combat zone, aircraft land or takeoff at 3-minute intervals under ideal conditions and the time required on the ground is reduced to 30 minutes. Service and maintenance is limited to emergency requirements only, and the tactical situation normally will not permit more time than that required for actual unloading and reloading.

d. For transport aircraft use, airfields in rear of the combat zone should be considered operational both day and night, while airfields in the combat zone may be operational only during daylight hours, depending on the enemy air capabilities.

237. Transport Aircraft Capabilities

a. Specific transport aircraft capabilities are affected by the state of modification and the aircraft, the nature of the climate and terrain in operating areas, and many other variable factors. In preparing for air movements, it is always necessary to secure specific capabilities from the Air Force operating agency which is to execute the move.

b. Availability of transport aircraft for continuous operation and for planning purposes may be taken as 75 percent of the total aircraft assigned to the project.

238. Air Movement of Supplies

a. *General.* Supplies may be free-dropped, landed as bulk shipments in powered aircraft, or landed by parachute in standard containers or by heavy drop.

b. *Bulk Supplies.*

- (1) When using aircraft to move bulk supplies the allowable cargo load to be carried will be determined by the radius or range to be flown. The allowable cargo loads of aircraft operating under *radius conditions* can be determined from the graphs in paragraph 239c.
- (2) To determine the aircraft requirements for bulk supplies, the following formula may be used.

(Airplanes—all types):

$$y = \frac{b}{x}$$

y = number aircraft required.

b = weight of supplies in pounds to be landed.

x = allowable cargo load of airplane in pounds for radius or range used.

Example. To determine C-119 aircraft requirements for air landing of 600 tons of supplies to be moved 500 miles under radius conditions.

1. Allowable cargo load for 500 miles under radius conditions is determined to be 17,000 pounds.
2. Total weight of supplies $600 \times 2,000 = 1,200,000$ pounds.

$$3. y = \frac{1,200,000}{17,000} = 70.6 \text{ or } 71 \text{ C-119s.}$$

c. *Parachute.*

- (1) The amount of supplies to be landed by parachute from various type airplanes is dependent on the number and type of

containers that can be carried, and rapidly discharged from the airplane. Three airplanes, the C-82, C-119, and C-97, are fitted with monorail and floor level conveyor systems, which facilitate the rapid discharge of the containers. The net weight of supplies carried in each type airplane thus differs, due to the capabilities of the aerial delivery system, and is much less than the allowable cargo load of the airplane at most distances.

- (2) To determine aircraft requirements for the delivery of parachute supplies, the same basic formula used for bulk supplies may be used:

$$y = \frac{b}{x}$$

The value of x can be determined from the graphs for the type aircraft given in paragraph 239c.

- (3) Under special conditions the three aircraft listed in (2) above, may carry greater tonnages of net supplies. Other aircraft also may be utilized to deliver parachute supplies, the amount to be carried being dependent on the existing conditions for dropping the containers.

239. Cargo Aircraft

a. General. The data in this paragraph are designed to present for use by division, corps, and higher staff planners those characteristics and capabilities of cargo aircraft needed by them in the conduct of planning for airborne operations. The aircraft data presented are an estimate of the actual performance data which may be expected during time of war. Some aircraft loads exceed design load conditions but are within acceptable alternate overload limits. The method of presentation used is designed to show the capabilities of the several aircraft in each of the types of operations in which they may be employed. These operations are—

Parachute.

Air-transport.

b. Glossary of Terms.

Allowable cargo load (air)—The amount of cargo, determined by weight, cubic displacement, and distance to be flown, which may be transported by aircraft. In an airborne operation, the Air Force commander will announce the allowable cargo load for each type aircraft.

Variations in the allowable cargo load—The allowable cargo load of an aircraft varies according to distance and certain other conditions. The greater the distance, the greater the weight of fuel and resultant reduced allowable cargo load. In radius operations, the

allowable cargo load for the distance traveled, for parachute operations, generally is greater than that for air-landed operation. This is due to the fact that in air-transported operations there is a necessary safety restriction on the total weight of the aircraft on landing. The allowable cargo load for an aircraft can be determined for any range or radius by reference to graphs provided for that purpose.

Radius of action—The maximum distance to which an airplane can safely travel and return without refueling. Operations under radius conditions are those in which aircraft deliver troops or materiel at a destination and return without refueling.

Range—The distance from the takeoff point to the point where an airplane delivers its cargo load (safety margin of reserve fuel included). Refueling is required to return to the original takeoff point.

Typical safe equipment loads—These are combination equipment loads within the weight limits of the allowable cargo load that expeditiously and safely can be loaded into a cargo aircraft without modification or disassembly, and which can be balanced and secured for safe flight. Vehicle and trailer loads are computed on empty weights for simplicity. This permits simple computation of remaining weight capacities.

Weight factors—The following factors are used in all computations:

A fully equipped parachutist weighs 260 pounds.

A fully equipped passenger weighs 240 pounds.

Representative types of aerial delivery containers:

A-7A Container. Net capacity—447 pounds, gross weight—500 pounds.

A-21 Container. Net capacity—424 pounds, gross weight—500 pounds.

A-22 Container. Net capacity—2,142 pounds, gross weight—2,200 pounds.

The 3,500-pound aerial delivery platform has a net capacity of 3,500 pounds, and a gross weight of 4,400 pounds.

The 6,000-pound aerial delivery platform has a net capacity of 6,000 pounds, and a gross weight of 7,850 pounds.

The 7,000-pound aerial delivery platform has a net capacity of 7,000 pounds, and a gross weight of 8,500 pounds.

c. *Aircraft Characteristics.*

(1) *C-54 Skymaster.*

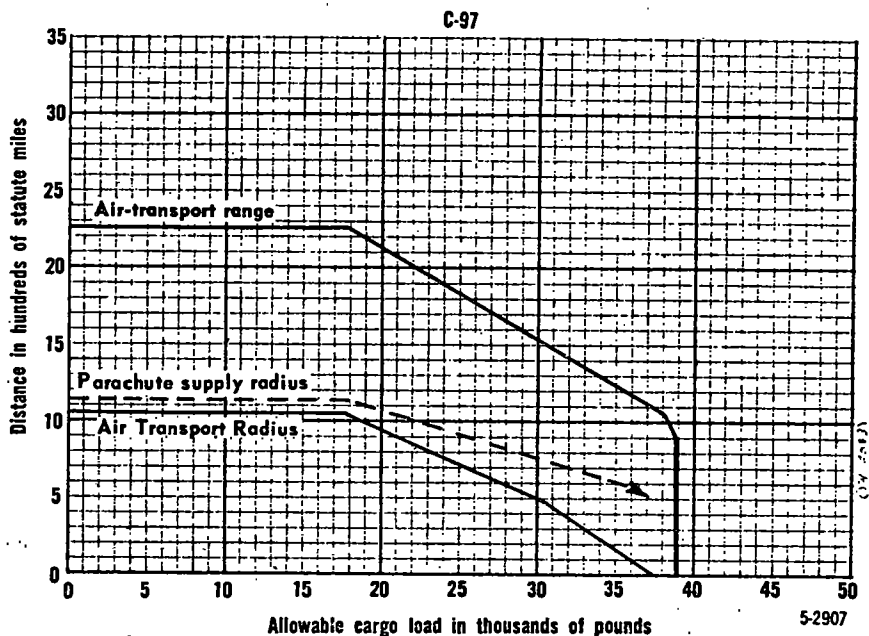
(a) *Description.* The C-54 Skymaster is a low-wing, all metal, four-engine medium transport. (Limited standard.)

(b) *Troop transport provisions.*

1. Number of troop seats—49.

2. Troop entrance—through door at left rear of fuselage by means of removable step or organic ladder.
3. Baggage—in cargo compartment with troops or in compartment below flight deck.
- (c) *Litter transport provisions.* Number of litter positions—36.
- (d) *Cargo transport provisions.*
 1. Cargo compartment dimensions.
 - (a) Length—597 inches.
 - (b) Width—108 inches.
 - (c) Height—93 inches.
 2. Height of cargo entrance above ground—100 inches.
 3. Cargo doors.
 - (a) Location—Left rear side of fuselage.
 - (b) Dimensions—95" wide x 67" high.
- (2) *C-97, Stratofreighter.*
 - (a) *Description.* The C-97 is a low-wing, all-metal, four engine heavy transport airplane.
 - (b) *Troop transport provisions.*
 1. Number of troop seats—134.
 2. Troop entrance—one door on each side of main compartment, one door on left side of lower front compartment.
 3. Means of loading—troop steps or ramp for personnel, ramp for vehicles.
 - (c) *Litter transport provisions.* Number of litter positions—83 (in place of seats).
 - (d) *Cargo transport provisions.*
 1. *Cargo compartment provisions.*
 - (a) Main cargo compartment—764" long, 105½" wide (max.), 87" (min.); 96" high (max.); 87" high (min.).
 - (b) Lower cargo compartments, two each—264" long, 74" wide, and 60" high.
 2. Height of cargo compartment above ground—164 inches.
 3. Cargo door—on rear underside of fuselage on level of main compartment. Size opening—88" to 110" wide x 96" to 120" high.
 - (e) *Parachutist provisions.* This aircraft is not equipped for personnel parachute operations.
 - (f) *Aerial delivery provisions.*
 1. Overhead monorail conveyors are provided which drop containers through flight operable rear cargo doors. The capacity of the overhead monorail is 85-300 pounds or 15-1,500-pound containers (using A-22 containers).

2. Floor level conveyors from cargo doors are provided for gravity ejection during flight.
3. The capacity for dropping packaged supplies from floor level conveyor is limited only by allowable cargo load.
4. Heavy dropping of equipment from the C-97 has not yet been tested.



(g) *Typical equipment loads.*

1. 6 trucks, $\frac{1}{4}$ -ton 4 x 4.
2. 4 trucks, weapons carriers, $\frac{3}{4}$ ton, 4 x 4.
3. 2 trucks, weapons carriers, $\frac{3}{4}$ ton, 4 x 4. 2 guns 40-mm, M1, on carriage M2A1.
4. 3 trucks, cargo, SWB, $2\frac{1}{2}$ -ton, 6 x 6, w/canvas cab.

Note. Combinations above can be carried only at distances for which the allowable cargo load is more than stated total weight of the vehicles.

(3) *C-119 Packet.*

(a) *Description.* The C-119 Packet is a high wing, twin boom, twin engine, all metal, medium transport.

(b) *Troop transport provisions.*

1. Number of seats—42 (20 additional seats can be installed).
2. Troop entrance—through at left front of fuselage by means of organic ladder.
3. Baggage—in cargo compartment with troops.
4. Number of air transported troops—62.

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(c) *Litter transport provisions.*

1. Number of litter positions—35.
2. Attendants—4.

(d) *Cargo transport provisions.*

1. Cargo compartment dimensions—see page 404.
2. Height of cargo entrance and floor above ground—48".
3. Ground clearance under horizontal stabilizers—164".
4. Cargo door:
 - (a) Location—rear of fuselage.
 - (b) Dimensions—see page 404.
5. Cargo loading aids:
 - (a) Vehicles—portable ramps and snatch block fittings.
 - (b) Bulk cargo—truck bed height of cargo floor and snatch block fitting for heavy loads.

(e) *Parachutist provisions.*

1. Maximum capacity—42.
2. Exit doors—at rear of fuselage on each side of the compartment.
3. Accompanying supplies—can be dropped from the interior aerial delivery system.

(f) *Aerial delivery provisions.*

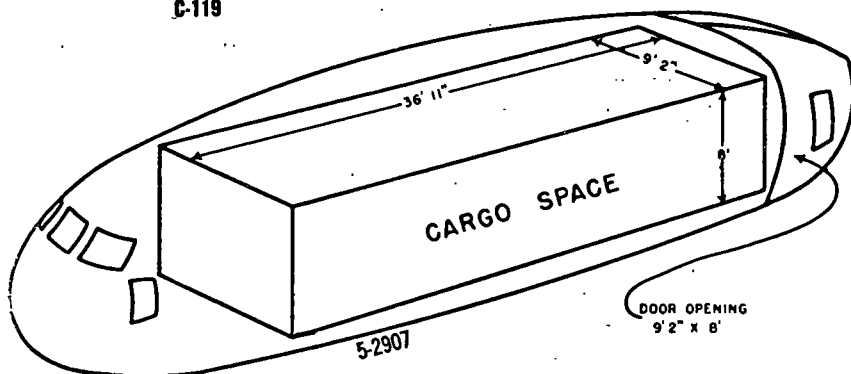
1. Monorail—aircraft are equipped with an interior overhead monorail system for discharging supplies through the paratainer well. Capacity of the monorail—20—500-pound aerial delivery containers (10,000 pounds).
2. Floor level conveyors—all models of this aircraft can be fitted for ejecting supplies or equipment from the rear of the fuselage. The clamshell cargo doors are removed and the supplies or equipment are placed on top of wheel conveyors positioned on the floor of the cargo compartment. Capacity of the conveyor system is governed only by the allowable cargo load and interior dimensions of the aircraft. With clamshell doors removed, seven 2,200-pound A-22 (aerial resupply) equipment containers can be ejected from the cargo compartment out of the cargo door on a 806-mile radius mission.

(g) *Typical safe equipment loads (air landed).*

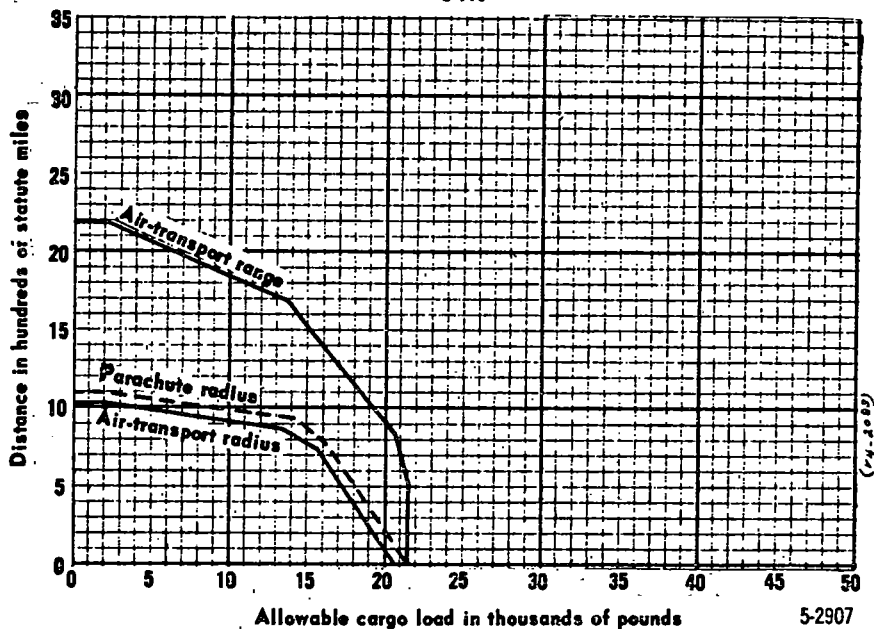
1. 3 trucks $\frac{1}{4}$ ton 4 x 4, and 3 trailers $\frac{1}{4}$ -ton.
2. 2 weapons carrier $\frac{3}{4}$ -ton, 4 x 4.
3. 1 truck, cargo, $2\frac{1}{2}$ -ton, LWB, 6 x 6, with canvas cab, and 1 trailer, $1\frac{1}{2}$ -ton, 2-wheel.
4. 1 truck, $\frac{3}{4}$ -ton, 4 x 4, M37 and 1 howitzer, 105-mm, M2A1, carriage M2A2.
5. 1 truck, $\frac{3}{4}$ -ton, 4 x 4 amb. and 1 truck, $\frac{3}{4}$ -ton, 4 x 4, M37.

6. 1 tractor, crawler-type, diesel, 8,600–12,000 DBP, D6, with dozer.
7. 1 truck, $\frac{3}{4}$ -ton, 4 x 4, and 1 gun, 76-mm AT, T-124 on carriage T-66.

C-119



C-119



Note. Combinations above can be carried only at distances for which the allowable cargo load is more than the stated total weight of the vehicles.

(h) *Heavy drop capabilities.* The C-119 can drop the following heavy equipment intact:

1. 3 trucks, $\frac{1}{4}$ -ton.
2. 2 trucks, $\frac{1}{4}$ -ton.
3. 1 truck, $2\frac{1}{2}$ -ton, 1 trailer $\frac{1}{4}$ -ton.
4. 1 truck, $\frac{1}{4}$ -ton, 1 gun, AT 76-mm.
5. 1 truck, $\frac{1}{4}$ -ton, 1 howitzer 105-mm, 2 containers 2,200 pounds.
6. 1 gun, 40-mm, 1 quad 50 MG, 1 container 2,200 pounds.
7. 2 cargo carriers, M 29 C (weasel).
8. 18,000 pounds of boxed supplies.
9. 7 containers, 2,200 pounds.

(i) *Mixed loads.* The C-119 can deliver the following mixed loads (equipment and personnel):

- 1 truck, $\frac{1}{4}$ -ton; 1 howitzer, 105-mm; followed by 4 personnel.
- 1 truck, $2\frac{1}{2}$ -ton, followed by 4 personnel.

(4) *C-123.*

(a) *Description.* The C-123 medium assault airplane is a high-wing, twin engine, full-cantilever monoplane of metal and steel tubing construction. It is capable of landing and taking off from unprepared fields.

(b) *Troop transport provisions.*

1. Number of troop seats—60.
2. Troop entrance—personnel doors on each side in rear portion of the fuselage. Dimensions— $60\frac{5}{8}$ " high, $30\frac{3}{8}$ " wide. An additional door is located on the left side in the forward portion of the fuselage.
3. Baggage—in cargo compartment with troops.
4. Number of air transported troops—60.

(c) *Litter transport provisions.* Number of litter positions—50.

(d) *Parachute provisions.* This aircraft is equipped for delivery of personnel by parachute, and for limited heavy drop.

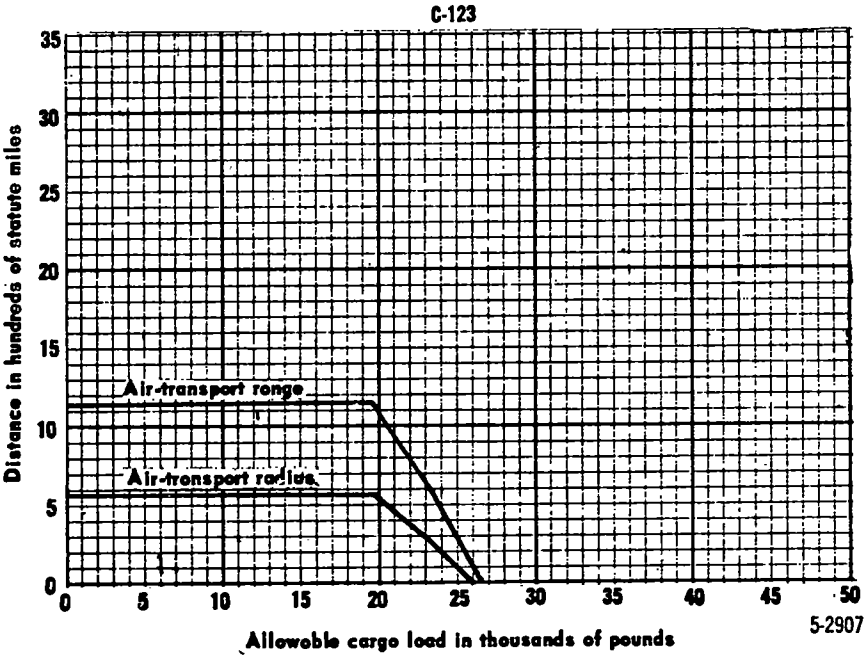
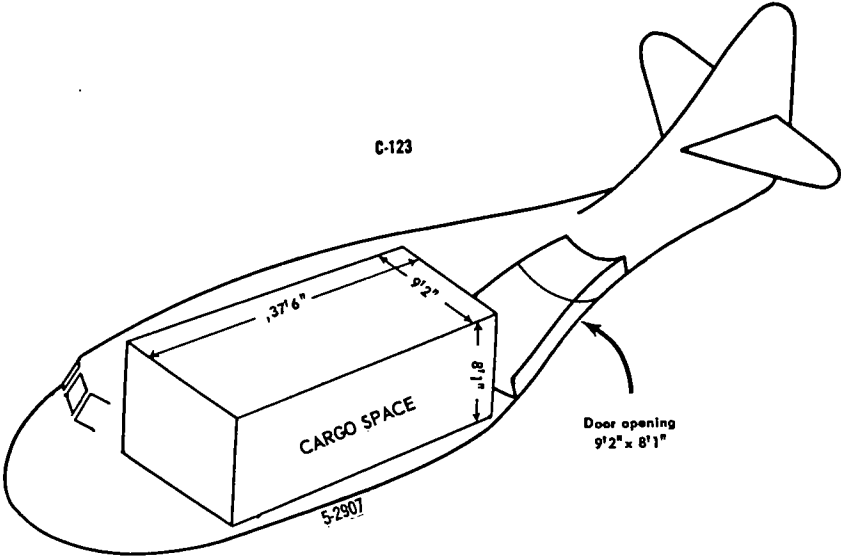
(e) *Aerial delivery provisions.* The C-123 will be tested in the near future for dropping heavy equipment by the use of floor conveyors.

(f) *Typical equipment loads.*

1. 3 trucks, $\frac{1}{4}$ -ton 4 x 4, and 3 trailers, $\frac{1}{4}$ -ton.
2. 2 trucks, weapons carrier, $\frac{1}{4}$ -ton, 4 x 4.
3. 1 howitzer, 155-mm, M1.
4. 1 compressor, air, truck-mounted gasoline engine.
5. 1 carrier, half-track. 1 81-mm mortar, M21.
6. 1 truck, cargo, $2\frac{1}{2}$ -ton, 6 x 6 SWB; with canvas cab, and 1 howitzer, 105-mm, M2A1, on carriage, M2A2.

7. 1 tractor, crawler type, diesel, 8,600-12,000 DBP, D-6, with dozer.

Note. Combinations above can be carried only at distances for which the allowable cargo load is more than the stated total weight of the vehicles.



(5) C-124.

(a) *Description.* The C-124 is a low wing, all metal, four engine, heavy transport monoplane.

(b) *Troop transport provisions.*

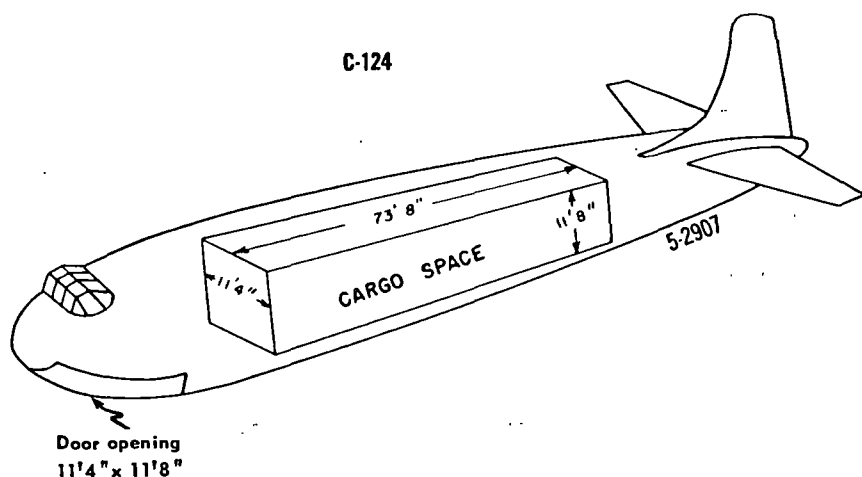
1. Number of troop seats—200 (located on two decks).
2. Baggage—in cargo compartment with troops or in compartments below flight deck.
3. Troop steps or ramp for personnel.

(c) *Litter provisions.* Number of litter positions—127 (in place of seats).

(d) *Parachutist provisions.* This aircraft can accommodate 112 parachutists when kit is installed. Aircraft can accommodate equipment bundles up to size of A-22 container. It is not planned to use this aircraft for heavy drop because of limited capability and excessive weight penalty.

(e) *Cargo transport provisions.*

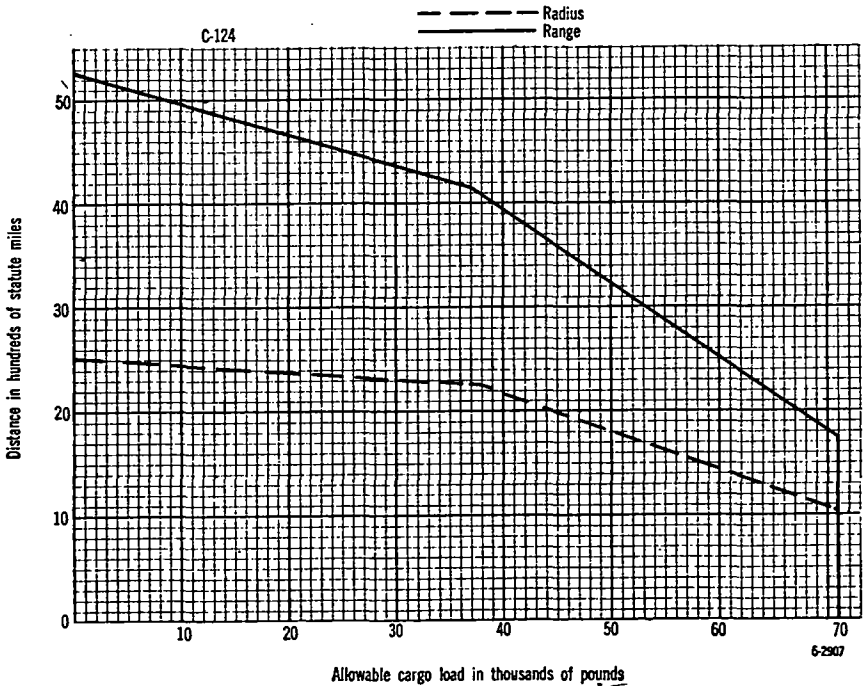
1. Overall dimensions (see illustration below).
2. Cargo compartment equipped with two decks.
3. Cargo door—clamshell doors open lower half of nose of airplane.
4. Cargo and equipment can be loaded either through the nose door by use of a ramp or by elevator in the aft end of the cargo compartment.
5. Dimensions of cargo door in nose—11.6' high x 11.3' wide.
6. Cargo elevator dimensions—13.3' long x 7.7' wide, capacity—16,000 pounds. Ground clearance of aircraft at elevator well—13.0'.



(f) *Typical equipment loads.*

1. 8 trucks, $\frac{1}{4}$ -ton, 4 x 4, and 8 trailers, $\frac{1}{4}$ -ton, 2-wheel.
2. 1 tank, light, M-41.
3. 1 howitzer, 155-mm, M1, on carriage, M1A2.
4. 1 tractor, high-speed, 13-ton M5A3.
5. 3 trucks, $2\frac{1}{2}$ -ton, 6 x 6, cargo, SWB, with winch.
6. 3 trucks, $2\frac{1}{2}$ -ton, 6 x 6, cargo, LWB.
7. 1 howitzer, 105-mm, M2A1, on carriage, M2A2; 1 trailer, ammunition M10; 1 truck, $2\frac{1}{2}$ ton, 6 x 6, SWB.
8. 1 carriage, motor, twin 40-mm gun, M19.
9. 12 trucks, $\frac{1}{4}$ -ton, 4 x 4, M38.
10. 1 vehicle, utility, armored M44.
11. 2 graders road, motorized diesel, engine driven 12-foot mold board.
12. 1 gun, 90-mm, AA, M2, on mount AA, M-2, with equipment and supply; 1 truck, $2\frac{1}{2}$ -ton, 6 x 6 cargo.
13. 4 helicopter reconnaissance, H-13 or H-23.

Note. Combinations above can be carried only at distances for which the allowable cargo load is more than the stated total weight of the vehicles.



Section XI. OCEAN SHIPPING

240. Definition of Ship-Loading Terms*a. Units of Weight.*

Short ton (S/T)—2,000 pounds. Used by U. S. ships in domestic trade.

Long ton (L/T)—2,240 pounds. Used by U. S. ships in foreign trade.

Metric ton—2,205 pounds. Used by foreign shipping.

b. Units of Volume.

(1) Measurement ton (M/T)—40 cubic feet. Used by U. S. ships in foreign trade.

(2) Register ton—100 cubic feet (this tonnage is used for working out a basis to collect entry fees for the vessel and has no direct bearing on the cargo carrying capacity of the vessel).

c. Units of Distance and Speed.

(1) *Distance.* Nautical mile=6,080 feet.

(2) *Speed.* Knot=1 nautical mile per hour.

d. Gross Tonnage. Gross tonnage (gross register tonnage) is the entire internal cubic capacity of a ship expressed in register tons of 100 cubic feet each.

e. Net Tonnage. Net tonnage (net register tonnage) of a ship represents the cargo and passenger earning spaces which remain after deduction from the gross tonnage of space for the crew, powerplant, fuel, and operation of the vessel. Net tonnage is expressed in tons of 100 cubic feet each.

f. Deadweight Tonnage. Deadweight tonnage is the carrying capacity of a ship expressed in long tons and represents the difference between displacement loaded to maximum draft allowed by law and displacement light.

g. Displacement Tonnage Light. Displacement tonnage light is the weight of a ship in long tons and excludes the weight of cargo, passengers, fuel, water, stores, dunnage, and such other items necessary for use on a voyage.

h. Displacement Tonnage Loaded. Displacement tonnage loaded is the weight of a ship in long tons and includes the weight of cargo, passengers, fuel, water, stores, dunnage, and such other items necessary for use on a voyage.

i. Cargo Deadweight Tonnage. Cargo deadweight tonnage is the weight-lifting capacity of a ship in long tons, remaining after deducting from the deadweight tonnage the weight of fuel, water, stores, dunnage, and such other items as may be necessary for a voyage.

j. Grain Cubic Capacity. Grain cubic capacity is the maximum space available for cargo measured in cubic feet, the measurements being taken to the inside of the shell plating of the ship or to the outside of the frames and to the top of the beams or under side of the deck plating. If a bulk cargo of grain were loaded, it would flow in between the frames and beams and occupy the maximum space available. This is the grain cubic capacity.

k. Bale Cubic Capacity. Bale cubic capacity of a ship is the number of cubic feet of space available for cargo measured to the inside of the cargo battens, on the frames, and to the underside of the beams.

l. Lost Space. Lost space (broken stowage, stowage loss) is the difference between the ship's cubic measurement and total measurement of the cargo. Although allowance for lost space varies a great deal with individual types of cargo, the average allowance for the entire spread of military cargo amounts to the following, which is given in percentage of bale cubic capacity:

	<i>Percent</i>
(1) Commercial loading.....	20
(2) Commodity loading.....	30
(3) Combat loading.....	50
(4) Selective loading.....	30

m. Stowage Factor. A stowage factor is a relationship of cubage to weight. As applied to cargo, it is the ratio of the number of cubic feet of space occupied by the cargo to the weight of the cargo in long tons. The units in which a stowage factor is expressed are stated as "cubic feet per long ton." In individual items or types of cargo, it is the amount of cubic feet of space occupied by one long ton.

n. Vessel Stowage Factor. Vessel stowage factor = (bale cubic capacity—estimated lost space) ÷ (cargo deadweight tonnage—estimated weight of deck cargo).

- (1) *Example problem:* To determine whether weight or volume of a specific commodity will be the limiting factor in loading a Liberty type ship of 400,000 cubic feet capacity after deducting lost space and with a cargo capacity tonnage (less deck load) of 8,000 long tons.

$$\begin{aligned}\text{Vessel factor} &= \frac{400,000 \text{ cubic feet}}{8,000 \text{ long tons}} \\ &= 50 \text{ cubic feet/long ton}\end{aligned}$$

- (2) Under the conditions stated above, the vessel will have its cargo space completely filled and its weight capacity utilized if stowed with cargo occupying 50 cubic feet to the long ton.

In this example for cargo occupying more than 50 cubic feet per long ton, volume will be the limiting factor. For cargo occupying less than 50 cubic feet per long ton, weight will be the limiting factor.

241. Definitions of Shipping Terminals

a. Wharf. A wharf is a projecting platform of timber, stone, or other material which extends into water deep enough for vessels to be accommodated alongside for loading or unloading.

b. Quay. A quay is a wharf parallel with the shoreline of a basin or harbor with water and accommodations for ships on one side only.

c. Pier. A pier is a wharf which projects into the harbor or basin with water and accommodations for ships on both sides.

242. Shipping References

a. Naval Logistical Reference Data.

b. U.S. Marine Corps Amphibious Manual A. M. 11 (1949).

243. Commercial Loading Methods

a. Bulk and General Cargo Loading. Bulk and general cargo loading is the stowage of supplies to utilize the entire carrying capacity of a ship disregarding segregation of cargoes either by class, technical service, or commodity. It permits maximum economy in shipping space but requires additional labor and facilities at destination for segregation and assembly of supplies for use.

b. Multiple Port Discharge. Multiple port discharge utilizes bulk stowage of supplies for more than one destination loaded so as to maintain availability for discharge of proper items in the order of arrival at the ship's scheduled destinations.

244. Military Loading Methods

Military cargo is loaded on board ships according to its intended employment at its destination. There are four distinct types of military loading.

a. Combat Loading. Combat loading gives primary consideration to facility with which troops, equipment, and supplies can be unloaded and ready for combat upon landing, rather than to economical utilization of ship space. There are three methods of combat loading. They differ mainly as to the degree of availability of troop units for landing and as to the tactical integrity of the units.

(1) *Combat unit loading.* Combat unit loading is the loading of an assault troop unit, together with its essential combat

equipment and supplies, in a single ship, in such a manner that they will be available to support the tactical plan upon debarkation, and to provide for a maximum of flexibility to meet possible changes in the tactical plan.

- (2) *Combat organizational loading.* Combat organizational loading is the loading of a troop unit with its equipment and supplies on the same ship, but without regard to tactical considerations upon debarkation. It permits debarkation of complete units and equipment which are available for employment after assembly ashore. This method is more economical in ship space than combat unit loading.
- (3) *Combat spread loading (also called Convoy Loading).* Combat spread loading is the loading of troop units, with their equipment and supplies, on ships in the same convoy, but not necessarily the same ship. This method is commonly used with troop units with heavy equipment. Units so loaded are available for employment when landed at established beachheads or ports, after a lapse of time necessary to assemble them on land with their equipment and supplies.

b. Commercial Loading. Commercial loading gives primary consideration to the loading of troops and/or equipment and supplies in a ship for maximum utilization of personnel and cargo space. No consideration is given to debarkation priorities. Therefore, equipment and supplies must be unloaded and sorted before they can be used. This type loading may be employed effectively for reinforcing and maintaining an expeditionary force and for carrying supplies and equipment for the buildup forces.

c. Commodity Loading. Commodity loading is—

- (1) In naval usage, a method of loading in which various types of cargo are loaded together, such as ammunition, rations or boxed vehicles, in order that each commodity can be discharged without disturbing the others.
- (2) In Army and Air Force usage, a method of loading a ship with one class of supply or with supplies of a single technical service.

d. Selective Loading. Selective loading is the arrangement and stowage of equipment and supplies aboard a ship in a manner designed to facilitate issues to units. Specific items may be discharged on call.

245. Nomenclature of Maritime Commission Oceaing Vessels

Note. There is such a large difference in the cubic carrying capacity of vessels of the same type because of various alterations and special fittings, that the cubic feet and tonnage figures shown in the following tables are, in most instances, minimum and apply to one type of the designated vessels only.

Type	Deadweight tonnage	Remarks
B7	5,800	Concrete hull, cargo barge, nonpropelled.
C1A	7,416	Designed for general cargo in world trade, steam turbine and motor propelled (2 modifications).
C1B	9,100	Designed for general cargo in world trade, steam turbine and motor propelled (3 modifications).
C1M	5,000	Designed for general cargo, motor propelled.
C1S	5,310	Concrete ship designed for cargo purposes, steam-reciprocating-engine propelled.
C2	8,514	Designed for general cargo in world trade majority steam turbine propelled (several modified types). Modified types were used mostly as hospital ships.
C3	9,937	Combination passenger and cargo ship, majority steam turbine propelled (several modified types).
C3	12,929	Designed for cargo, steam turbine propelled.
C4	13,200	Designed for cargo, steam turbine propelled (2 modifications).
C4	7,000	Designed for troops, steam turbine propelled (4 modifications).
C4-S-1A.	13,409	Mariner Class Vessel. Recently developed by Maritime Administration in co-operation with the Department of Defense to provide modern high speed commercial type vessels which can readily be converted for wartime shipping.
EC2	10,800	Liberty type designed for general cargo; steam-reciprocating-engine propelled. Several modified types, prefixed by the symbol "Z" were designed as tank carriers and later modified as plane carriers.
L6	15,580	Specially designed for bulk ore coal or grain trade on the Great Lakes, steam-reciprocating-engine propelled.
N3	2,905	Cargo carrier designed for coastal trade, steam-reciprocating-engine propelled.
P1	1,877	Specially designed passenger-type vessel, steam turbine propelled.
P2	8,759-11,800	Designed to carry troops. Two types, one turbine-electric propelled, one steam turbine propelled.
T1	1,483-4,205	Designed for tanker service in coastal and inland waters, diesel propelled (4 modifications).
T2	16,765	Designed to carry bulk oil in world trade, turbo-electric propelled, (4 modifications).
T3	18,333	Designed to carry bulk oil in world trade, steam turbine propelled (6 modifications).
V2	100	Diesel-powered tug for general towing purposes. Two types; steel hull, wood hull.
V4	786	Large diesel-powered oceangoing tug.
VC2	10,820	Victory type designed to carry cargo in world trade. Four types, one has 6,000 HP engine, three have 8,500 HP engines. Three are steam turbine propelled, one diesel propelled.

246. Vessel Planning Data—General Characteristics

Vessel Planning Data—General Characteristics Capacity^a

Type loading	Vessel type	Type cargo ^b	Troops	Cargo (including vehicles) ^c
Combat.....	APA	Combat equipment.....	1,500	800
Combat.....	AKA	Combat equipment.....	300	2,500
Combat.....	LSD	Combat equipment.....	200	^d 1,500
Combat.....	LST	Combat equipment.....	150	^e 500
Combat.....	LSM	Combat equipment.....	50	^f 1,600
				^g 165
				^h 337
Convoy.....	AK	Combat equipment.....	100	5,000
Convoy.....	AP	Combat equipment.....	3,800	800
Comm.....	Victory.....			4,600
	Troop.....		3,800	
	Tanker bulk POL.....			140,000 barrels

^a Capacities given are for planning purposes only and should be used only when specific vessels assigned are *unknown*.

^b Average troop ship is considered to have sufficient cargo capacity for personal equipment and baggage of its rated passenger load.

^c Cargo capacity is in short tons and includes the weight of vehicles when loaded but does not include weight of troops with their personal equipment and baggage.

^d With no temporary decking typical load is 3 LCU or 18 LCM (6) or 41 LVT or 47 amphibious trucks. With temporary decking a load of 92 LVT or 108 amphibious trucks may be carried.

^e Combat load for beaching.

^f Heavy loaded not intended for beaching purposes.

^g Capacity to lift medium tanks: LSD-9; LST-10; LSM-4.

247. Cargo Vessel Characteristics

a. Physical Characteristics.

	1	2	3	4	5	6	7
1	Vessel	Gross register tonnage	Overall length (ft)	Beam (ft)	Sustained speed (knots)	Cruising radius (naut mi)	Summer draft (ft)
2	Liberty.....	7,100	442	57	11.0	¹ 9,000	28
3	Victory.....	7,600	455	62	15.5	23,000	29
4	C1 B Cargo.....	6,700	418	60	14.0	18,000	28
5	C2 Cargo.....	6,058	459	63	15.0	16,000	26
6	C3 Cargo.....	7,950	492	70	16.5	12,000	29
7	C4 Cargo.....	11,500	520	71	17.0	14,000	33
8	FS Freighter ²	560	176	32	12.0	4,640	10
9	C1 M AV 1 Freighter.....	3,860	339	50	11.0	14,500	23
10	T2E Tanker.....	10,200	524	68	14.5	8,000	30
11	ZET 1 Tanker ³	7,000	442	57	11.0	17,000	28
12	C4 Mariner.....	9,200	564	76	20.0		30

¹ Cruising radius can be increased to 18,000 miles if deep tanks are used for fuel oil. See footnote 2 in c below.

² FS type (freight service ship) is the 176-foot vessel built for the Army. It is an oceangoing vessel but, because of its small capacity, is used principally as an interisland carrier.

³ Converted Liberty.

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b. Hold, Hatch, and Boom Data.

	1	2	3	4	5	6
1	Vessel	Cargo holds (number)	Boom capacity (LT)	Booms (number)	Capacity heavy lift rigs (LT)	Hatches w/ heavy lift booms (by number)
2	Liberty.....	5	5	12	¹ 50-15	2-4
3	Victory.....	5	5	16	¹ 50-30	1 3-4
4	C1 B Cargo.....	5	5	17	30	2
5	C2 Cargo.....	5	5	17	50	3
6	C3 Cargo.....	5	5-10	21	30	5
7	C4 Cargo.....	7	5	24	50	4-5
8	FS Freighter ²	2	5	4	15	2
9	C1 M AV 1 Freighter.....	4	1½-5	12	30	2-3
10	T2E Tanker.....	9	2-5	3	-----	-----
11	ZET 1 Tanker ³	9	5	-----	-----	-----
12	C4 Mariner.....	7	5-10	26	60	4-5

¹ Some Liberties have a 30-ton boom at No. 2 hatch; all have 15-ton booms at No. 4. All Victories have 30-ton booms at No. 4 hatch.

² FS type (freight service ship) is the 176-foot vessel built for the Army. It is an oceangoing vessel but, because of its small capacity, is used principally as an interisland carrier.

³ Converted Liberty.

c. Vessel Capacities.

	1	2	3	4	5	6	7
1	Vessel	Dead-weight (LT)	Meas. tons ^{1 2}	Bale cubic capacity (cu ft) ^{1 2}	Grain cubic capacity (cu ft) ¹	Ref. cargo (cu ft)	Liquid cargo (hbls)
2	Liberty.....	10,800	11,500	460,000	535,000	-----	5,000
3	Victory.....	10,600	11,750	470,000	523,000	-----	-----
4	C1 B Cargo.....	9,100	11,400	456,000	499,000	-----	-----
5	C2 Cargo.....	9,722	12,600	504,000	638,000	-----	-----
6	C3 Cargo.....	12,510	17,300	697,020	782,110	32,890	-----
7	C4 Cargo.....	15,000	15,600	640,000	727,481	32,375	-----
8	FS Freighter.....	440	483	19,320	-----	-----	-----
9	C1 M AV 1 (Coaster).....	5,010	5,640	225,600	250,000	9,830	4,000
10	T2E Tanker.....	16,760	⁴ 375	-----	-----	-----	141,000
11	ZET 1 Tanker ³	10,800	-----	-----	-----	-----	65,000
12	C4 Mariner.....	13,419	18,418	736,723	837,305	30,254	-----

¹ On-deck space or lost space in stowage not included.

² Does not include capacity of deep tanks of which the Liberty type ship has 3. Deep tanks No. 1 and No. 2 with approximately 16,000 cubic feet of capacity may be used for dry or liquid cargoes if not in use for vessel voyage requirements. No. 3 deep tank is rigged for either fuel oil or bulk cargo liquids. A 5,000 barrel (703 LT) payload can be shipped in this tank if the contemplated voyage is to be short enough that No. 3 tank will not be needed for fuel oil.

³ Converted Liberty.

⁴ Dry cargo hold.

d. Detailed Capacities Below Deck.

	1	2	3	4	5	6
1	Ship type	Hatch number	Hatch dimensions	Cargo capacities in measurement tons		
				Hold	'Tween deck	Deep tanks
2	Liberty.....	1	33 ft. 9 in. x 20 ft.	900	1,000	140
3	.....	2	35 ft. 0 in. x 20 ft.	2,300	1,100	270
4	.....	3	20 ft. 0 in. x 20 ft.	1,500	600	460
5	.....	4	35 ft. 0 in. x 20 ft.	1,300	700	-----
6	.....	5	35 ft. 0 in. x 20 ft.	1,300	800	-----
7	Total.....		-----	7,300	4,200	870

	1	2	3	4	5	6	7
1	Ship type	Hatch number	Hatch dimensions	Cargo capacities in measurement tons			
				Hold	Upper 'tween deck	Lower 'tween deck	Deep tanks
2	Victory ¹	1	22 ft. 4 in. x 25 ft.	698	1,468	595	0
		2	22 ft. 4 in. x 24 ft.	699	675	545	0
		3	22 ft. 4 in. x 36 ft.	1,321	1,139	945	0
		4	22 ft. 4 in. x 36 ft.	1,278	1,230	0	1,047
		5	22 ft. 4 in. x 33 ft.	648	1,091	0	367
	Total.....		-----	4,644	4,603	2,085	1,414
3	C 1 B ¹	1	27 ft. 0 in. x 20 ft.	581	571	429	166
		2	31 ft. 6 in. x 20 ft.	1,195	904	778	0
		3	31 ft. 6 in. x 20 ft.	1,102	977	785	233
		4	31 ft. 6 in. x 20 ft.	0	974	1,085	0
		5	27 ft. 0 in. x 20 ft.	0	644	470	0
	Total.....		-----	2,878	4,070	3,547	399
4	ZEC-5 ¹	1	40 ft. 0 in. x 20 ft.	1,334	1,472	0	143
		2	40 ft. 0 in. x 20 ft.	1,676	1,357	1,642	272
		3	40 ft. 0 in. x 20 ft.	1,226	1,073	0	244
		4	20 ft. 0 in. x 20 ft.	500	0	0	606
	Total.....		-----	4,736	3,902	1,642	1,265
5	Mariner.....	1	24 ft. 3 in. x 18 ft. 6 in.	305	402	453	
		2	30 ft. 0 in. x 24 ft. 0 in.	637	731	865	
		3	40 ft. 0 in. x 30 ft. 0 in.	1,284	1,050	1,454	
		4	40 ft. 0 in. x 30 ft. 0 in.	1,528	1,006	1,500	
		5	40 ft. 0 in. x 30 ft. 0 in.	401	1,044	410	953
		6	40 ft. 0 in. x 30 ft. 0 in.	1,646	965	-----	298
		7	25 ft. 0 in. x 30 ft. 0 in.	856	627		
	Total.....		-----	6,657	5,825	4,682	1,251

¹ Capacities given for the 3 vessels mentioned here are averages of loading reports and reflect varying lost space factors. For overall planning not related to specific vessel loadings, use data in c above.

²Known as the "focsle."

e. *Composition of Deadweight Tonnage.* With the addition of the ZEC 5, a modified Liberty ship for use in shipment of planes or other bulky cargo, four types comprise the majority of all shipping available for military use. Further detailed data for these vessels follow. It is to be noted that ships' capacities are expressed in long tons in order to agree with normal shipping procedures, whereas the discharge and loading capabilities of Transportation Corps port companies are expressed in short tons in order to agree with practices of other modes of transportation.

	1	2	3	4
1	Vessel	Maximum ship-operating supplies*	Cargo capacity tonnage when operating supplies are maximum *	Total
2	Liberty-----	2,800 LT	8,000 LT	10,800 LT
3	Victory-----	3,100 LT	7,500 LT	10,600 LT
4	C1B-----	1,850 LT	7,250 LT	9,100 LT
5	ZEC-5-----	3,770 LT	5,430 LT	9,200 LT

*Operating supplies include fuel, water, dunnage, and ship stores. Additional payload capacity may be substituted to a limit dependent on length of voyage and character of cargo which will warrant a reduction in such ship-operating supplies.

f. *Vehicle Loading Capacities.*

	1	2	3	4	5	6	7	8	9	10	11
1	Type of ship	Trucks ¼-ton ¹		Trailers 1-ton ¹		Comd and Ren cars ¾-ton ¹		Trucks, 1½ ton 4 x 4 ¹		Trucks, 2½ ton 6 x 6, (LWB) ¹	
		On wheels	Crated ²	On wheels	Crated ²	On wheels	Crated ²	On wheels	Crated ²	On wheels	Crated ²
2	Liberty-----	498	2,078	404	4,493	312	744	214	607	* 135	357
3	Victory-----	512	1,983	512	4,287	331	710	278	579	193	340
4	C1B-----	511	1,912	491	4,133	330	634	276	558	179	328
5	ZEC-5-----	493	1,748	402	3,800	301	629	215	513	163	302

¹ Double the number of ¼-ton trucks on wheels can be stowed if they are stacked. It also is estimated that at least 35 percent more 1-ton trailers can be loaded if stowed in tandem with drawbar nested inside body of preceding trailer, provided tail gates are drop type. Regarding the other three types of vehicles, more can be stowed in the Liberty ship by double-decking; see note to C1B table in g below.

² All crated vehicles are boxed by single units except the 1-ton trailers which are boxed by twin units.

³ 153 ¼-ton trucks may be loaded in the bodies of 153 of these trucks. The other 32 trucks will not take jeeps because of the limiting height of the compartments in which stowed. As an alternative, a total of 215 trucks can be stowed by double-decking in Nos. 2 and 3 holds.

g. Detailed Vehicle Loading Capacities (stowed on wheels).

C I B*

1	2	3	4	5	6	7
Hatch No.	Location	Trucks ¾-ton	Trailers 1-ton	Comd and Rcn cars ¾-ton	Trucks 1½-ton 4 x 4	Trucks 2½-ton 6 x 6 LWB
1	On deck.....	14	14	12	8	5
	Upper 'tween deck.....	21	18	12	10	6
	Lower 'tween deck.....	21	18	12	10	6
	Lower hold.....	14	13	9	6	3
2	On deck.....	25	21	18	16	12
	Upper 'tween deck.....	46	37	25	22	13
	Lower 'tween deck.....	42	37	25	22	15
	Lower hold.....	34	36	21	20	13
3	On deck.....	23	21	14	16	10
	Upper 'tween deck.....	44	42	30	22	17
	Lower 'tween deck.....	41	42	28	21	13
	Lower hold.....	41	42	28	21	13
4	On deck.....	21	21	14	14	10
	Upper 'tween deck.....	39	41	26	21	14
	Lower 'tween deck.....	36	37	24	19	12
	On deck.....	16	18	12	12	7
5	Upper 'tween deck.....	23	23	15	12	7
	Lower 'tween deck.....	10	10	5	4	3

*Number of vehicles in lower holds of Nos. 2 and 3 hatches can be doubled by flooring over one layer of vehicles and loading a second layer directly on top. The depth of only these two holds will permit such double-decking.

Liberty Ship

1	2	3	4	5	6	7	8	9
Hatch No.	Location	Trucks ¾-ton	Trailers 1-ton	Comd and Rcn cars ¾-ton	Trucks 1½-ton 4 x 4	Trucks 2½-ton 6 x 6 LWB	Wpns carr ¾-ton 4 x 4	Pers carr 1½-ton 6 x 6
1	On deck.....	22	22	14	10	9	14	10
	'Tween deck.....	28	27	23	15	12	23	17
	Lower hold.....	28	24	18	14	10	18	12
	On deck.....	41	36	20	14	13	20	16
2	'Tween deck.....	54	44	30	23	21	30	24
	Lower hold.....	48	42	*30	*20	*18	*30	*20
	On deck.....	22	14	10	9	6	10	6
	'Tween deck.....	36	28	25	16	14	25	17
3	Lower hold.....	32	28	*22	*14	*12	*22	*14
	On deck.....	31	20	16	12	11	16	12
	'Tween deck.....	41	37	27	18	16	27	21
	Lower hold.....	20	15	13	8	10	18	10
4	On deck.....	31	22	14	14	11	14	14
	'Tween deck.....	44	34	25	20	16	25	20
	Lower hold.....	20	11	20	7	6	20	10

*Based on no center-line bulkhead which may or may not be standard equipment.

Victory Ship*

1	2	3	4	5	6	7
Hatch No.	Location	Trucks ¾-ton	Trailers 1-ton	Comd and Ren cars ¾-ton	Trucks 1½-ton 4 x 4	Trucks 2½-ton 6 x 6 LWB
1	On deck.....	14	12	6	5	5
	Upper 'tween deck.....	15	16	9	8	5
	Lower 'tween deck.....	16	18	9	10	6
	Hold.....	15	13	8	7	4
2	On deck.....	18	16	12	11	7
	Upper 'tween deck.....	29	26	17	15	10
	Lower 'tween deck.....	25	24	17	15	10
	Hold.....	21	21	14	12	8
3	On deck.....	25	29	18	18	13
	Upper 'tween deck.....	48	48	29	26	17
	Lower 'tween deck.....	46	46	30	25	18
	Hold.....	44	46	30	25	18
4	On deck.....	23	25	18	18	13
	'Tween deck.....	49	48	34	23	16
	Hold.....	49	49	31	24	18
	On deck.....	25	25	17	11	6
5	'Tween deck.....	30	31	20	15	12
	Hold.....	20	19	12	10	7

* There are no available aircraft data for the Liberty, Victory, and C 1 B ships, since their holds are not adaptable to plane stowage, and consequently they were seldom used for this purpose.

ZEC-5

1	2	3	4	5	6	7
Hatch No.	Location	Trucks ¾-ton	Trailers 1-ton	Comd and Ren cars ¾-ton	Trucks 1½-ton 4 x 4	Trucks 2½-ton 6 x 6 LWB
1	On deck.....	28	21	15	14	7
	'Tween deck.....	46	40	30	22	18
	Hold.....	42	43	29	21	17
	On deck.....	26	21	15	14	9
2	Upper 'tween deck.....	70	58	43	28	23
	Lower 'tween deck.....	81	60	45	31	24
	Hold.....	66	59	46	33	26
	On deck.....	26	19	15	10	9
3	'Tween deck.....	60	42	33	22	16
	Hold.....	48	39	30	20	14

h. The ZEC-5, a modified EC-2 (Liberty ship) is fitted with hatches larger than on ordinary Liberty ships, thereby permitting under-deck stowage of certain types of assembled aircraft in addition to those carried on deck.* Typical aircraft loading capacity by hatches is as follows:

* There are no available aircraft loading data for the Liberty, Victory, and C 1 B ships, since their holds are not adaptable to plane stowage, and consequently they were seldom used for this purpose.

Hatch No.	Location	Type of aircraft			
		P-51 ¹	P-47D ¹	P-47N ¹	P-80 ²
1	On deck.....	5	4	4	4
	'Tween deck.....	6	4	4	-----
	Hold.....	5	3	3	-----
	On deck.....	5	4	4	4
2	Upper 'tween deck.....	9	5	3	9
	Lower 'tween deck.....	9	5	4	8
	Hold.....	8	5	4	7
	On deck.....	5	4	4	4
3	'Tween deck.....	6	3	3	5
	Hold.....	5	3	3	3
	On deck.....	2	1	1	1
4	On deck.....	2	1	1	1
Total per ship.....		65	41	37	45

¹ With propellers, wing tips, and stabilizers removed.

² Totals on P-80 aircraft are based on loading of one vessel. The tail section(s) is boxed and a large box is required for each unit; all of number 1 between deck and hold are filled with boxed tail section(s) and motors.

248. Approximate Sailing Distances in Nautical Miles

Ports	Ports of embarkation						
	Boston	New York	Charles- ton	New Orleans	Los Angeles	San Francisco	Seattle
<i>United States</i>							
Boston.....		200	900	2,000	¹ 5,100	¹ 5,400	¹ 6,200
New York.....	200		600	1,700	¹ 4,900	¹ 5,300	¹ 6,000
Charleston.....	900	600		1,200	¹ 4,500	¹ 4,900	¹ 5,600
New Orleans.....	2,000	1,700	1,200		¹ 4,300	¹ 4,700	¹ 5,500
Los Angeles.....	¹ 5,100	¹ 4,900	¹ 4,500	¹ 4,300		400	1,100
San Francisco.....	¹ 5,400	¹ 5,300	¹ 4,900	¹ 4,700	400		800
Seattle.....	¹ 6,200	¹ 6,000	¹ 5,600	¹ 5,500	1,100	800	
<i>North Atlantic</i>							
Newfoundland, St. Johns.....	900	1,100	1,700	2,600	¹ 5,700	¹ 6,000	¹ 6,800
Greenland, Ivigtut.....	1,700	1,900	2,400	3,400	¹ 6,500	¹ 6,800	¹ 7,600
Iceland, Reykjavik.....	2,300	2,500	3,000	4,000	¹ 7,100	¹ 7,400	¹ 8,200
<i>European</i>							
United Kingdom:							
Liverpool.....	3,000	3,200	3,700	4,700	¹ 7,600	¹ 7,900	¹ 8,700
Southampton.....	3,000	3,200	3,600	4,600	¹ 7,500	¹ 7,800	¹ 8,600
Northern Ireland, Belfast.....	2,900	3,000	3,400	4,400	¹ 7,200	¹ 7,500	¹ 8,300
Norway, Oslo.....	3,900	4,100	4,400	5,300	¹ 8,200	¹ 8,600	¹ 9,400
Russia:							
Archangel.....	4,000	4,200	4,800	5,800	¹ 8,800	¹ 9,200	¹ 10,000
Murmansk.....	3,700	3,800	4,400	5,400	¹ 8,500	¹ 8,900	¹ 9,700
France:							
Le Havre.....	3,000	3,200	3,600	4,600	¹ 7,500	¹ 7,800	¹ 8,600
Brest.....	2,900	3,100	3,500	4,500	¹ 7,400	¹ 7,700	¹ 8,500
Bordeaux.....	3,000	3,200	3,700	4,700	¹ 7,600	¹ 7,900	¹ 8,700
Belgium, Antwerp.....	3,200	3,400	3,800	4,800	¹ 7,700	¹ 8,000	¹ 8,800

Ports	Ports of embarkation						
	Boston	New York	Charles-ton	New Orleans	Los Angeles	San Francisco	Seattle
<i>Mediterranean</i>							
France, Marseille.....	2 3, 700	2 3, 900	2 4, 300	2 5, 300	1 8, 000	1 8, 200	1 9, 000
Italy, Naples.....	2 4, 000	2 4, 200	2 4, 600	2 5, 600	1 8, 300	1 8, 500	1 9, 300
Algeria, Algiers.....	2 3, 400	2 3, 600	2 4, 000	2 5, 000	1 7, 700	1 8, 000	1 8, 800
St. of Gibraltar.....	3, 000	3, 200	3, 600	4, 600	1 7, 300	1 7, 500	1 8, 300
<i>Caribbean and South Atlantic</i>							
Bermuda, Hamilton.....	700	700	800	1, 700	1 4, 600	1 4, 900	1 5, 800
Puerto Rico, San Juan.....	1, 500	1, 400	1, 100	1, 500	1 3, 900	1 4, 300	1 5, 100
Trinidad, Port of Spain.....	2, 000	1, 900	1, 700	2, 100	1 4, 100	1 4, 400	1 5, 300
Brazil, Rio de Janiero.....	4, 700	4, 800	4, 700	5, 200	1 7, 200	1 7, 600	1 8, 400
Argentina, Buenos Aires.....	5, 800	5, 900	5, 800	6, 300	1 8, 300	1 8, 700	1 9, 600
Panama Canal, Panama.....	2, 200	2, 000	1, 600	1, 400	2, 900	1 3, 200	4, 000
<i>Middle East</i>							
Egypt, Port Sald.....	2 4, 900	2 5, 100	2 5, 500	2 6, 500	1 9, 200	1 9, 500	1 10, 300
Arabia, Aden.....	2 6, 300	2 6, 500	2 6, 900	2 7, 900	1 10, 600	1 10, 900	1 11, 700
Turkey, Istanbul.....	2 4, 800	2 5, 000	2 5, 400	2 6, 400	1 9, 100	1 9, 400	1 10, 200
Iran, Khorramsbahr (Persian Gulf).....	2 8, 300	2 8, 500	2 8, 900	2 9, 800	1 12, 600	1 12, 900	1 13, 700
<i>North Pacific</i>							
Alaska, Duteb Harbor.....	1 7, 400	1 7, 300	1 6, 900	1 6, 700	2, 400	2, 100	1, 700
<i>Middle Pacific</i>							
Hawaiian Islands, Honolulu.....	1 6, 900	1 6, 700	1 6, 300	1 6, 100	2, 200	2, 100	2, 400
Marshall Islands, Kwajalein.....	1 9, 200	1 9, 000	1 8, 600	1 8, 400	4, 200	4, 410	4, 500
Marianas Islands, Guam.....	1 10, 200	1 10, 000	1 9, 600	1 9, 400	5, 600	5, 100	4, 900
Japan, Yokohama.....	1 9, 900	1 9, 600	1 9, 500	1 9, 100	4, 800	4, 500	4, 200
<i>South West Pacific</i>							
New Guinea, Finschhafen.....	1 10, 200	1 10, 000	1 9, 600	1 9, 400	6, 100	5, 900	6, 000
Philippine Islands, Manila.....	1 11, 600	1 11, 300	1 11, 000	1 10, 800	6, 600	6, 300	6, 100
Australia:							
Brisbane.....	1 9, 900	1 9, 600	1 9, 300	1 9, 100	6, 300	6, 200	6, 500
Melbourne.....	1 10, 100	1 9, 900	1 9, 500	1 9, 400	7, 000	7, 000	7, 300
East Indies, Singapore.....	2 9, 900	1 10, 100	2 10, 500	2 11, 500	7, 900	7, 500	7, 100
<i>China-India-Burma</i>							
Cbina:							
Shangbal.....	1 10, 800	1 10, 600	1 10, 200	1 10, 000	5, 700	5, 400	5, 100
Hongkong.....	1 11, 400	1 11, 200	1 10, 800	1 10, 600	6, 400	6, 000	5, 700
India:							
Bombay.....	2 8, 000	2 8, 200	2 8, 600	2 9, 500	1 2 12, 200	1 2 12, 600	1 2 13, 400
Calcutta.....	2 9, 600	2 9, 800	2 10, 200	2 11, 200	1 2 13, 900	1 2 14, 200	1 2 15, 000
Burma, Rangoon.....	2 9, 600	2 9, 800	2 10, 200	2 11, 200	1 2 13, 900	1 2 14, 200	1 2 15, 000
East Russia, Vladivostok.....	1 9, 500	1 9, 300	1 8, 900	1 8, 700	9, 000	8, 600	8, 200
					5, 000	4, 600	4, 400

1 Via Panama Canal.

2 Via Strait of Gibraltar.

249. Shipping Turn-Around Times

a. General. Turn-around time for similar type ships seldom will be the same between two ports, or other equidistant runs, unless sailings are carefully controlled. Assuming controlled operating conditions, a basis for turn-around times can be established for type ships (troop or cargo) for general planning purposes.

b. Turn-Around Time Components. Turn-around time components are—

- (1) Loading time at home port.
- (2) Steaming time to and from destination.
- (3) Unloading and loading time at destination.
- (4) Unloading time at home port.
- (5) Normal voyage repair and reoutfitting time.

c. Planning Factors.

- (1) Sailing distances per day:*

Cargo Ships:

Slow—240 nautical miles.

Fast—360 nautical miles.

Passenger Ships:

Slow—360 nautical miles.

Fast—432 nautical miles.

- (2) Time in ports per round trip for unloading, loading, voyage repairs and reoutfitting.

Cargo ships—35 days.

Troop ships—20 days.

Tankers—10 days.

- (3) Convoys and effect on turn-around time. A major portion of shipping may be conducted in convoy formation, the speed of which is dictated by the slowest vessel in each convoy. This factor must be considered when computing turn-around time for convoy or escorted shipping.

*For convoy sailing speed of advance deduct 10 percent for delays in forming convoys, zigzagging on route, etc. The 10 percent loss factor is not applicable to ships in the "Fast" category since such ships will normally proceed individually.

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Ports	Ports of embarkation*													
	Boston		New York		Charleston		New Orleans		Los Angeles		San Francisco		Seattle	
	Type of shipping													
	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo
<i>United States</i>														
Boston.....									48	72	50	74	54	82
New York.....									46	70	49	74	53	80
Charleston.....									45	67	47	71	51	77
New Orleans.....									44	67	46	69	51	77
Los Angeles.....	48	72	46	70	45	67	44	67						
San Francisco.....	50	74	49	74	47	71	46	69						
Seattle.....	54	82	53	80	51	77	51	77						
<i>North Atlantic</i>														
Newfoundland, St. John.....			27	40	30	45	36	53	55	82	57	85	61	92
Greenland, Ivigtut.....	30	45	31	47	35	52	41	61	60	89	62	92	66	100
Iceland, Reykjavik.....	34	50	35	52	38	57	44	67	63	95	65	97	70	106
<i>European</i>														
United Kingdom:														
Liverpool.....	38	57	39	59	43	64	49	73	66	100	68	102	73	110
Southampton.....	38	57	39	59	42	63	48	72	66	99	68	102	72	109
Northern Ireland, Belfast.....	38	56	38	57	41	61	47	70	64	96	66	99	71	106
Norway, Oslo.....	44	66	45	68	47	70	52	78	70	105	72	109	77	116
Russia:														
Archangel.....	44	67	46	69	49	74	55	83	73	111	76	114	81	122
Murmansk.....	43	64	43	65	47	70	53	80	72	108	74	112	79	119

France:														
La Havra.....	38	57	39	59	42	63	48	72	66	99	68	102	72	109
Brest.....	38	56	39	58	41	62	48	71	65	97	67	101	72	108
Bordeaux.....	38	57	39	59	43	64	49	73	66	100	68	102	73	110
Belgium, Antwerp.....	39	59	41	61	43	65	49	74	67	101	69	103	73	111
<i>Mediterranean</i>														
France, Marseille.....	43	64	44	66	46	69	52	78	69	103	70	106	75	113
Italy, Naples.....	44	67	46	69	48	72	54	81	71	106	72	108	77	115
Algeria, Algiers.....	41	61	42	63	44	67	50	76	67	101	69	103	73	111
Strait of Gibraltar.....	38	57	39	59	42	63	48	72	65	97	66	99	71	106
<i>Caribbean and South Atlantic</i>														
Bermuda, Hamilton.....							30	45	48	72	50	75	55	83
Puerto Rico, San Juan.....	29	44	28	42	27	40	29	44	44	66	40	69	50	76
Trinidad, Port of Spain.....	32	48	31	47	30	45	33	49	45	68	47	70	62	78
Brazil, Rio de Janeiro.....	49	73	49	74	49	73	51	78	64	90	66	100	71	107
Argentina, Buenos Aires.....	55	83	56	84	55	83	59	88	71	106	73	110	78	118
Panama, Panama Canal.....	33	48	32	48	30	45	28	42	38	56	39	59	44	67
<i>Middle East</i>														
Egypt, Port Said.....	50	75	50	76	54	80	60	89	76	114	78	117	83	124
Arabia, Aden.....	51	78	60	89	62	93	68	102	85	127	86	130	92	137
Turkey, Istanbul.....	49	74	50	76	53	80	59	89	76	113	77	116	82	124
Persia, Basra.....	71	106	72	108	73	110	80	120	97	145	99	147	104	155
<i>North Pacific</i>														
Alaska, Dutch Harbor.....	65	97	65	97	62	93	61	91	35	52	33	49	30	45
<i>Middle Pacific</i>														
Hawallan Islands, Honolulu.....	62	93	61	91	59	88	57	86	33	48	33	49	35	52
Marshall Islands, Kwajalein.....	76	114	75	113	72	109	71	107	46	69	47	70	48	71
Marianas, Guam.....	82	124	81	122	78	118	77	116	54	81	50	76	50	75
Japan, Yokohama.....	80	121	79	118	78	117	76	113	49	74	48	71	46	69

See footnotes at end of table.

Ports	Ports of embarkation*													
	Boston		New York		Charleston		New Orleans		Los Angeles		San Francisco		Seattle	
	Type of shipping													
	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo	Troop	Cargo
Southwest Pacific														
New Guinea, Finschhafen.....	82	124	81	122	78	118	77	116	57	86	56	84	57	85
Philippines, Manila.....	91	136	89	133	87	131	86	129	60	90	59	88	57	86
Australia:														
Brisbane.....	80	121	78	118	77	115	76	113	59	88	58	87	60	89
Melbourne.....	82	123	80	121	78	117	77	116	62	94	62	94	65	97
East Indies, Singapore.....	80	121	82	123	83	126	90	134	68	102	66	99	63	95
China-India-Burma														
China:														
Shanghai.....	86	129	85	127	82	124	81	122	55	82	53	80	50	76
Hongkong.....	90	135	88	132	86	129	85	127	59	89	57	85	55	82
India:														
Bombay.....	69	103	70	106	72	109	78	117	94	142	97	145	102	153
Calcutta.....	79	118	80	120	82	124	88	132	83	124	80	121	78	117
Burma, Rangoon.....	79	118	80	120	82	124	88	132	78	117	76	113	73	110
East Russia, Vladivostok.....	78	117	77	115	74	112	73	110	165	157	108	160	112	167
									75	113	72	109	70	106
									50	76	48	72	47	70

*All turn-around times are based on the routes indicated in the table in paragraph 248 and on data given in c above. The turn-around times between ports with the exception of Inter U. S. port times includes a 10 percent safety factor for forming convoy zigzagging, etc.

CHAPTER 8

LOGISTICS—SERVICE

Section I. GENERAL

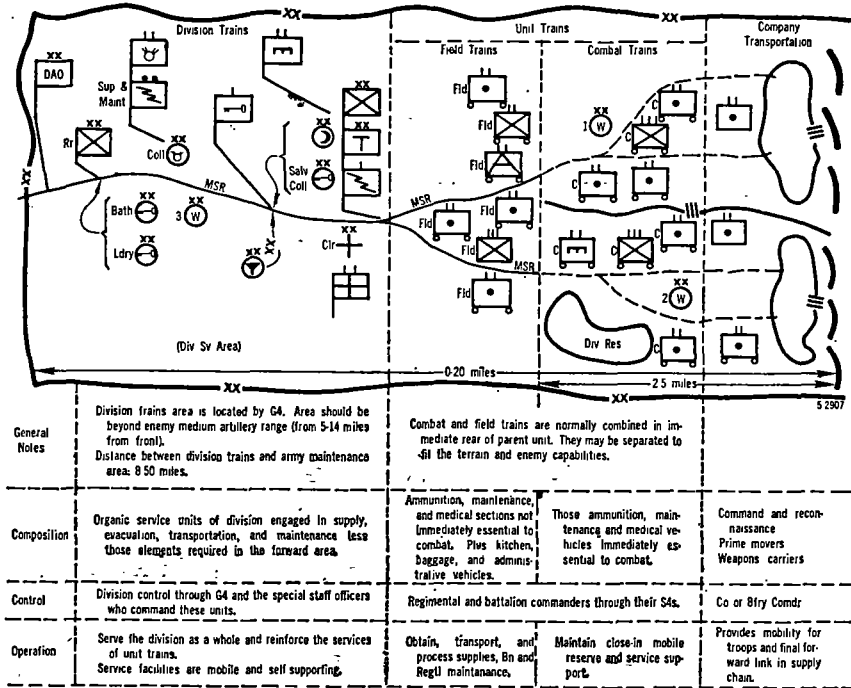
250. Coverage

This section contains information of and measurement factors involved in the services other than supply.

251. Cross References

- a.* Troop requirements for all services are found in paragraphs 47 through 53.
- b.* Characteristics of ordnance and chemical weapons are found in paragraphs 62 and 63.
- c.* Tactical signal communication is covered in paragraphs 64 through 71.
- d.* Field engineering is covered in paragraphs 72 through 79.
- e.* Characteristics of material of all services are covered in chapter 5.
- f.* Pipeline data, in addition to that in this section, are found in paragraphs 91, 93, 184 through 185, and 268.

252. Division Logistical Installations



- (1) The net construction strength of an average engineer construction unit is 60 percent of its TOE strength. The remaining 40 percent represents unit maintenance, administrative and command personnel and individuals not available for duty.
- (2) Sixty-five percent of the construction time is productive. The remaining 35 percent represents construction time lost due to adverse weather, job to job moves, enemy action, shortage of supplies, and similar time loss factors.
- (3) Each man normally works 10 hours per day, 6 days per week.
- (4) Two-shift operation is employed for construction equipment, allowing 4 hours for change of shift and maintenance of equipment.

b. Force Estimates. The force estimates outlined herein are based on average conditions encountered in the various theaters during World War II. They should be used only as a general planning guide and should be modified for known or expected conditions of particular operations.

c. Unit Equivalents. It is not practicable to state an average factor for construction effort of the various other engineer units, based on the battalion month yardstick, as defined in *a* above, which will be applicable to all types of construction projects. The quantity and type of equipment assigned to the unit and its training are important factors in determining its effectiveness on a particular type of construction work. For example, an Engineer combat battalion would be more effective than an Engineer construction battalion in the repair of roads in a combat zone (average factor 1.3), but an Engineer combat battalion would be much less effective than an Engineer construction battalion in the construction of a new road in the communications zone, requiring considerable earth moving (average factor 0.6). The below listed factors are based on the assumption that, in general, the average construction project in a combat zone requires much less heavy engineer equipment than the average construction project in a communications zone. The factors apply only to properly equipped engineer units of average experience. They should be used only in broad planning and do not apply to any one particular construction project. The many factors involved make it advisable that an experienced engineer officer, familiar with the technical details of a particular project, determine the type of engineer unit to be assigned to its construction, whenever practicable.

1	1	2	3
	Unit	Average construction effort factor	
		Combat zone	Communications zone
2	Engr Cons Bn.....	1.0	1.0
3	Engr Combat Bn.....	1.3	.6
4	Engr Avn Bn.....	.9	1.2
5	Engr Combat Bn plus Lt Equip Co.....	1.4	.9
6	Engr Cons Bn plus Hv Equip Co.....	1.2	1.4

255. Roads

a. Road Nets.

- (1) Construction and maintenance of roads in a theater of operations is held to the minimum required by the situation and is based on maximum use of the existing road net. The capacity of roads of various types, in short tons forward per day (t/d) is given in paragraph 218.

- (2) Normally the minimum road nets to be provided and maintained are as follows:

(a) In the combat zone—

1. One 500 t/d road per front line division forward of corps rear boundary.
2. One 2,000 t/d road and one 500 t/d road per corps forward of army rear boundary.
3. Lateral roads at 10-mile intervals in rear of division rear boundary, alternately 2,000 t/d and 500 t/d.
4. Access roads as required at depots, supply points, and other installations in corps and army service areas.

(b) In the communications zone—

1. One 2,000 t/d and one 500 t/d road from each major port to each army service area. Where only one port serves an army or a task force composed of a reinforced corps, a minimum of one 2,000 t/d and two 500 t/d roads.
2. Access roads as required at depots and other installation in the communications zone.

b. New Construction of Roads.

- (1) Construction policy. New road construction is undertaken only where absolutely necessary and normally it includes only such items as detours to bypass demolitions, and access roads. The factors below are given primarily for estimating rehabilitation as a percentage of the requirements for new construction.

- (2) Bridge and culvert requirements. For planning purposes it is assumed that 1 mile of new road requires 40 lineal feet of bridging and 7 culverts.
- (3) Material requirements for 1 mile of new road including bridges, culverts, asphalt and cement but no gravel nor aggregate.

1	1	2	3	4	5
	Type of road	Surface 12 feet wide		Surface 22 feet wide	
		Short tons	Measurement tons	Short tons	Measurement tons
2	Dirt.....	35	36	64	74
3	Gravel surface.....	51	58	100	117
4	3" asphalt surface.....	81	95	170	203
5	4" concrete surface.....	200	130	423	280
6	6" concrete surface.....	300	180	638	386

NOTE

Bridging as in (6) below except that bridging for dirt roads is assumed to be 75 percent timber and 25 percent steel stringers on timber substructures.

- (4) Gravel requirements for 1 mile of new road.

1	1	2	3	4	5
	Type of road	Surface 12 feet wide		Surface 22 feet wide	
		Cubic yards	Short tons	Cubic yards	Short tons
2	Gravel surface 4" thick*.....	782	1,173	1,434	2,151
3	Gravel surface 5" thick*.....	978	1,466	1,793	2,690
4	Gravel surface 6" thick*.....	1,174	1,761	2,151	3,226
5	3" asphalt surface.....	587	881	1,076	1,614
6	4" concrete surface.....	782	1,174	1,434	2,151

*Based on loose thickness. For compacted thickness, add 25 percent.

- (5) Corrugated metal culvert pipe requirements per mile of road, based on 30 lineal feet per culvert for roads 12 feet wide, 56 lineal feet for roads 22 feet wide, and 7 culverts per mile of road.

	1	2	3	4	5	6	7	8	9
1		Size inches, diameter	Percent	Surface 12 feet wide			Surface 22 feet wide		
				Linear feet	Weight, pounds	Cubic feet	Linear feet	Weight, pounds	Cubic feet
2	Average quantities for	18	15	4.5	72	1.22	8.4	134	2.27
3	culvert.	24	25	7.5	157	2.78	14.0	294	5.18
4	-----	36	30	9.0	333	7.38	16.8	629	13.94
5	-----	42	7	2.1	134	2.31	3.9	256	4.40
6	-----	48	15	4.5	324	6.35	8.4	605	11.84
7	-----	60	8	2.4	264	6.00	4.5	495	11.25
8	Total	-----	100	30.0	1,284	26.04	56.0	2,413	48.88
9	Quantities per mile	-----	-----	210.0	8,988	182.28	392.0	16,891	342.16
10	-----	Short tons		4.49			8.44		
11	-----	Measurement tons		4.56			8.55		

Notes

1. Example. 100 miles of 12-foot road requires 100 x 4.5 or 450 lin. ft. of 18-inch pipe, which is enough for 15 culverts. Total requirements for all sizes amount to 449 short tons, 456 measurement tons.

2. Estimate culvert installation at 5-man-hours per lineal foot or 1,050 man-hours per mile of 12-foot road, 1,960 man-hours per mile of 22-foot road.

(6) Fixed bridge requirements per mile of road, based on 40 lineal feet of bridge per mile of road and on average percentages of the various types of structures.

	1	2	3	4	5	6	7	8	9
1	Type of structure	Unit length, feet	Percent of 40 lineal feet	12 feet wide			22 feet wide		
				Short tons	Measure- ment tons	Man- hours	Short tons	Measure- ment tons	Man- hours
2	Timber	14-20	35	9.31	9.55	127	17.22	19.95	185
3	I-Beam H-35	30	25	9.46	11.36	210	18.92	22.72	420
4	I-Beam H-35	60	15	10.08	10.14	200	20.16	20.28	400
5	Thru Truss H-35	90	3½	3.26	3.75	48	6.52	7.50	96
6	Deck Truss H-20	125	9½	8.38	11.20	70	16.76	22.40	140
7	Through Truss Bailey D. D.	130	12	5.64	7.88	74	11.28	15.76	148
8	Total	-----	100	46.13	53.88	729	90.86	108.61	1,389

Notes

1. Timber bridge data, line 2 of table, is based on typical bridge having 3 14-foot spans of wood stringers and 2 20-foot spans of steel stringers.

2. The quantities are based on timber and wood pile substructures. If the planning includes steel trestle piers for 60 to 150 foot spans, add 0.500 short tons, 0.375 measurement tons, and 7½ man-hours per lineal foot of bridge for 12-foot width; double these quantities for 22-foot width.

3. Semipermanent highway steel bridges (lines 3, 4, and 5; see TM 5-285).

(7) Highway bridge construction.

(a) Types, capacities, and references.¹

	1	2	3	4
1	Type*	Span	Capacities	References
2	I-Beam, H-35...	30-foot.....	75-ton with caution.....	TM 5-286
3	I-Beam, H-35...	60-foot.....	75-ton with caution.....	TM 5-286
4	Truss, H-35.....	90-foot.....	Maximum of 70-ton with caution.....	TM 5-286
5	Bailey.....	30 to 180-foot..	18- to 70-ton depending on type and length of span....	TM 5-277 TM 5-286

*Refer to TM 5-285 and TM 5-277 for descriptions and details of construction.

(8) Construction effort, in net effective man-hours of engineer construction troops, required to grade and surface 1 mile of new road. (See note 2 below table.)

	1	2	3	4	5	6	7	8
1	Terrain	Surface 12 feet wide		Surface 22 feet wide				
		Grading	Surface		Surface			
			4-inch gravel	6-inch gravel	Grading	4-inch gravel	6-inch gravel	5-inch gravel, 3-inch asphalt
2	Flat-Prairie.....	2,500	5,000	5,600	3,500	6,500	7,200	20,800
3	Rolling.....	3,000	6,200	7,000	4,000	7,600	8,300	22,100
4	Hilly-Forested.....	4,700	8,300	9,200	5,500	10,000	10,500	25,000
5	Mountain-Forested—no rock.....	8,400	12,300	13,200	22,000	26,700	27,500	42,800
6	Mountain—some rock.....	14,000	18,400	19,500	36,500	47,000	51,500	62,000
7	Mountain—heavy rock.....	26,500	36,000	38,400	70,000	80,500	85,000	95,500

Notes

1. Based on pit-run gravel except lines 6 and 7, which are based on crushed rock.
2. The tabulated man-hours do not include bridges and culverts. Add 1,800 man-hours for 12-foot and 3,350 man-hours for 22-foot, for bridges and culverts as given in (5) and (6) above.

c. *Road Rehabilitation.* Materials and effort required to rehabilitate roads after action, in percentages of the materials and effort required for new construction.

	1	2
1	Rehabilitation of—	Equivalent percentages of new construction (percent)
2	Roads.....	10 to 20.
3	Culverts.....	15.
4	Bridges.....	50 to 75.

¹ Based on single-lane bridging.

d. Road Maintenance. After rehabilitation and not allowing for further damage in action, suitably trained and equipped engineer troops maintain roads on the basis of 15 man-hours net effective effort per mile of road per day.

e. Policy for Roads and Bridge Construction.

- (1) *Responsibility.* Between combat and communication zone, bridging is normally on an area basis. Communications zone forces take over all bridging operations in rear of the army area as rapidly as possible. All rearward elements assume bridge maintenance in forward areas as soon as the situation permits. Rearward engineer units are charged with replacing tactical and other portable types of bridging with non-portable types as quickly as possible, strengthening bridging to carry successively heavier loads, and for such bridge removal as the situation justifies.
- (2) *General bridge policy.* Tactical bridging is normally placed by corps engineers. Organizational equipage will be replaced as quickly as possible by rearward engineers with heavier bridging. Stocks of fixed and floating Bailey bridge, H-10 bridge, Type H-35 bridge, and timber trestle bridge with steel beams are available in depots for use in the communications zone and also in the combat zone where time and the tactical situation permit. Bailey bridging will be utilized by forward units where practicable. Replaced and surplus bridging is returned to depots.

256. Railway Construction

a. New Construction.

- (1) The railroad division used in planning includes 100 route miles of main line, single or double track, together with its terminal operating and maintenance facilities, fueling and watering facilities as required, and the necessary signaling equipment or interlocking facilities for safe operation. Passing sidings on single track lines, stations, and crossovers at double track lines at stations, are at intervals as required by the traffic. Normally at least one spur or siding is provided at each station.
- (2) Materials and man-hours (net effective) required for new construction of 1 mile of standard gage (4'8½"), single track railroad.

	1	2	3	4
	Item	Short tons	Measure- ment tons	Man-hours
1				
2	Grading.....			¹ 5,000
3	Ballast Production.....			² 2,500
4	Track Laying and Surfacing.....			³ 3,400
5	Bridging—70 lin. ft.....	91	90	2,400
6	Culverts—7.....	6	6	1,300
7	Ties—2,600.....	170	195	
8	Rail—75 lb.....	132	42	
9	Fastenings (based on 33 feet rail).....	27	8	
10	Total.....	426	341	14,600

¹ Includes clearing and is based on average wooded terrain.

² Includes hauling a reasonable distance.

³ Allows 400 man-hours per mile for placing ties. Allow for any additional time needed to haul ties.

(3) Materials and man-hours (net effective) required for new construction of a typical 100-mile standard gage (4'8½'') single track division.*

	1	2	3	4	5	6	7
	Item	Miles	Quantity	Turn- outs ⁶	Short tons	Measure- ment tons	Man- hours
1							
2	Grading ¹	100.0					500,000
3	Ballast production.....	100.0					250,000
4	Main line track ¹				15,900	5,000	300,000
5	Ties, (6" x 9" x 8').....		260,000		17,000	19,500	40,000
6	Sidings.....	4.5	18	36	1,880	1,500	21,200
7	Station trackage ²	3.0	12	24	1,087	876	14,400
8	Port trackage ²	3.0		24	1,087	876	14,400
9	Railway terminal.....	20.0	1	150	10,700	6,500	160,000
10	Railhead trackage ²	.6	2	4	209	166	3,200
11	Water stations ³		3		135	210	9,000
12	Coal and inspection facilities.....		1		19	16	900
13	Culverts (7 per mile).....		700		600	600	130,000
14	Bridging (70' per mile) ⁴				9,100	9,000	240,000
15	Contingencies ⁵				583	456	16,900
16	Total.....			238	58,300	44,700	1,700,000

¹ Includes clearing and is based on average wooded terrain.

² Based on 75-pound rail and include angle bars, spikes and other fastenings. Man-hours include ballast-ing, lining and surfacing.

³ Include 25,000 gallon tank, standpipe and 1,200 feet of water pipe per station.

⁴ Assumes 70 linear feet per mile of various types, some with steel trestles, some with pile and timber bents (TM 5-286).

⁵ Adds about 1 percent using arbitrary figures which round out the totals.

⁶ Include switch ties and switch stands.

* See FM 5-10 for definitions, descriptions of installations, and details.

b. Rehabilitation.

(1) Normally railroad demolition is heaviest near ports of entry, lighter inland. This is reflected in the table below, which

gives rehabilitation requirements for a 100-mile division extending inland from a port, using high percentages of demolition for the first 30 miles, lower ones for the next 70 miles. For planning purposes, still lower percentages of demolition may be assumed for lines farther than 100 miles inland.*

	1	2	3	4	5	6
1	Item and quantities	0 to 30 miles from the port ¹				
		Demolition (percent)	Rehabilitation (quantity)	Materials		Man-hours
				Short tons	Measurement tons	
2	Main line, 30 miles.....	20	6.0 mi.....	954	300	31, 200
3	Port trackage, 12, 3 miles ²	100	3.0 mi.....	1, 368	1, 092	14, 400
4	Passing sidings, 6, 1.5 miles ²	80	1.2 mi.....	547	437	5, 800
5	Station sidings, 4, 1.0 miles ²	80	.8 mi.....	365	291	3, 800
6	Railway terminal, 1 ^{2 3}	75	.75 ea.....	8, 025	4, 875	160, 000
7	Bridging, 2, 100 linear feet.....	75	1,575.0 ft.....	1, 575	1, 500	46, 200
8	Culverts, 210.....	15	32.0 ea.....	27	27	5, 800
9	Grading.....					17, 000
10	Ballast.....					21, 200
11	Ties, main line, 30 miles.....	6	1.8 mi.....	310	360	
12	Total.....			13, 171	8, 882	305, 400
				30 to 100 miles inland		
13	Main line, 70 miles.....	10	7.0 mi.....	1, 113	350	36, 400
14	Passing sidings, 12, 3 miles ²	80	2.4 mi.....	1, 049	874	11, 500
15	Station sidings, 8, 2 miles ²	80	1.6 mi.....	730	582	7, 700
16	Regulating station ^{2 4}		1.0 ea.....	7, 025	5, 754	140, 000
17	Water stations, 3.....	100	3.0 ea.....	135	210	9, 000
18	Fuel station, 1.....	100	1.0 ea.....	21	18	1, 000
19	Bridging 4,900 linear feet.....	55	2,700.0 ft.....	2, 700	2, 672	70, 000
20	Culverts, 490.....	15	74.0 ea.....	63	63	13, 700
21	Grading.....					18, 000
22	Ballast.....					22, 500
23	Ties, main line, 70 miles.....	5	3.5 mi.....	595	683	
24	Total.....			13, 656	11, 206	329, 800

¹ Tunnels require special consideration. To repair (by timbering) a 50-foot demolition at each end of a single-track tunnel (100' total per tunnel), allow 70 short tons, 87 measurement tons, and 3,000 man-hours.

² Estimate includes ties, rails, fastenings, turnouts, and track laying and surfacing. It assumes ballast is available at work sites.

³ Includes replacement of buildings 100 percent, ties 30 percent, rail and turnouts 85 percent.

⁴ Provides minimum requirements for replacement buildings, rail and turnouts 100 percent, ties 85 percent, man-hours 100 percent of new construction.

(2) Items and man-hours (net effective) required for rehabilitation of a typical 100-mile standard gage (4' 8½") single track division further than 100 miles inland.

*Reference: FM 5-10 for definitions and specifications.

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	1	2	3	4	5	6	7
1	Item	Miles track	Number	Turn-outs	Demolition (percent)	Rehabilitation	Man-hours
2	Main line.....	100			10	10 miles...	59,000
3	Sidings.....	7.5	30		10	0.7 mile....	4,100
4	Sidings.....			60	75	45.....	6,800
5	Terminal.....	20			50	10 miles....	59,000
6	Terminal.....			150	80	120 miles..	18,000
7	Terminal water station.....		1		100	1 mile.....	6,000
8	Terminal Eng House.....		1		100	1 mile.....	6,000
9	Terminal fuel station.....		1		100	1 mile.....	1,000
10	Wayside water station.....		3		100	3 miles....	9,000
11	Wayside fuel and inspection station.....		1		100	1 mile.....	1,000
12	Bridging—7,000 linear feet:						
	Major, 4,000 linear feet.....				75	3,000 L. F.	69,000
	Minor, 3,000 linear feet.....				35	1,000 L. F.	14,000
13	Culverts.....		700		15		19,500
14	Railhead.....	0.5		4	100	0.5 mile....	3,600
15	Grading main line.....						20,000
16	Grading sidings.....						1,000
17	Contingencies about 10 percent.....						28,000
18	Regulating station.....						140,000
19	Total.....						465,000

257. Port Construction

a. Approximate Planning Factors. The following planning factors give the materials and man-hours required for port facilities adequate for the handling of 720 short tons of discharged dry cargo per day of 20-hour operation. This is a convenient unit because it is the wharf discharge rate of one ship, Liberty type, as given in paragraph 231*d*. The facilities include ship or lighterage wharf space, access road from wharf to road net, and minimum covered and open storage. Of the four factors given, cases I and II are based on new wharf construction, the others on rehabilitation.

- (1) *Case I.* New construction of 500 linear feet of deep-draft marginal wharf (par. 231), and port facilities for 720 short tons per day.*

*If site conditions favor finger type piers 500 feet by 90 feet, 2 berths per pier, the above factors *per berth* continue to apply.

	1	2	3	4
1	Item	Short tons	Measurement tons	Man-hours
2	Timber pile marginal wharf, 500' x 60'.....	1,200	2,000	15,000
3	0.7 mile of access road, asphalt surfaced, 22' wide.....	65	80	14,000
4	2 miles of railroad including sidings ¹	675	500	14,500
5	10,000 square feet covered storage ²	65	45	1,800
6	60,000 square feet open storage.....			50
7	Total.....	2,005	2,625	45,350

¹ Based on 75-pound rail and upon normal requirements for service and yard tracks and for terminal car storage.

² Based on shell-type insulated warehouses (par. 280m) with 3-inch concrete floors.

(2) *Case II.* New construction of 350 linear feet of marginal lighterage wharf (par. 231) and port facilities for 720 short tons per day.

	1	2	3	4
1	Item	Short tons	Measurement tons	Man-hours
2	Timber pile marginal wharf 350' x 35'.....	600	800	8,400
3	0.7 mile of access road, asphalt surfaced 22' wide.....	65	80	14,000
4	2 miles of railroad including sidings [*]	675	500	14,500
5	10,000 square feet covered storage [*]	65	45	1,800
6	60,000 square feet open storage.....			50
7	Total.....	1,405	1,425	38,750

*Notes 1 and 2, case I, apply also to case II.

(3) *Case III.* Rehabilitation of 500 linear feet of deep-draft wharf, clearance of debris, and new construction of other port facilities for 720 short tons per day.

	1	2	3	4
1	Item	Short tons	Measurement tons	Man-hours
2	Repair of 500 linear feet of deep-water wharf ¹	1,375	2,190	25,000
3	0.7 mile of access road, asphalt surface 22' wide.....	65	80	14,000
4	2 miles of railroad including sidings ²	675	500	14,500
5	10,000 square feet covered storage ³	65	45	1,800
6	60,000 square feet open storage.....			50
7	Clearing debris ³			2,500
8	Total.....	2,180	2,815	57,850

¹ Based on repair of cratered wharf faces by timber and V-trestle construction to a width of 60 feet.

² Notes 1 and 2, case I, apply also to case III.

³ Based on 10 percent of the man-hours in line 2.

- (4) *Case IV.* Rehabilitation of 350 linear feet of lighterage wharf, clearance of debris, and new construction of other port facilities for 720 short tons per day.

	1	2	3	4
1	Item	Short tons	Measure- ment tons	Man-hours
2	Repair of 350 linear feet of lighterage wharf ¹	580	920	10,500
3	0.7 mile of access road, asphalt surface 22' wide.....	65	80	14,000
4	2 miles of railroad including sidings ²	675	500	14,500
5	10,000 square feet covered storage ²	65	45	1,800
6	60,000 square feet open storage.....			50
7	Clearing debris ²			1,100
8	Total.....	1,385	1,545	41,950

¹ Based on repair of cratered wharf faces by timber or steel sheet pile.

² Notes 1 and 2, case I; and note 3, case III, apply also to case IV.

b. Construction Rate for Pile-and-Timber Wharves. Normally, one engineer construction company constructs 500 linear feet of deep-draft marginal wharf, or equivalent, in about 6 days. These rates cannot be improved by using a force larger than a company on one wharf structure of these sizes, due to the sequences necessary in pile driving, capping, bracing, and deck construction.

c. Demolition of Existing Facilities. Experience in the invasion of developed harbors indicates the average percentages of demolitions to be anticipated are as tabulated below. In addition, the removal of sunken wrecks or blockships may be required; normally 2 or 3 in a small harbor, 10 to 20 in a large one. If the harbor entrance is narrow, it is usually found blocked.

	1	2
1	Facilities	Average demolition
2	Permanent wharves or quays.....	30 percent very badly damaged; early repair impracticable. 30 percent heavily damaged; much debris; reasonably early repair possible. 40 percent lightly damaged, less debris, early repair practicable.
3	Port cranes.....	100 percent destroyed.
4	Port warehouses.....	50 percent to 100 percent destroyed.

d. Utilities Required at Ship Wharves.

- (1) *Fresh water.* With pressures normal in municipal water supply, one 4-inch pipeline with three 2½-inch outlets refills a Liberty ship's capacity of 115,000 gallons in 6 hours.
- (2) *Illumination.* Five-hundred-watt incandescent lamps, mounted 35 feet above the wharf deck and spaced at in-

tervals of 120 feet, provide adequate illumination averaging 1 to 2 foot-candles.

e. Construction Factors for Specific Types of Deep-Draft Wharves and Approaches. The following information is based on details in TM 5-280, using wood piles and timber deck.

1	1	2	3	4
	Type of wharf	Short tons	Measure-ment tons	Man-hours
2	Finger pier 500' x 90', 60' piles, no railway.....	2,230	3,780	30,700
3	Finger pier 500' x 90', 60' piles, with railway.....	2,255	3,960	33,150
4	Finger pier 500' x 90', 80' piles, no railway.....	2,600	4,490	32,650
5	Finger pier 500' x 90', 80' piles, with railway.....	2,755	4,725	35,225
6	Marginal wharf 500' x 60', 60' piles, no railway.....	1,095	1,825	12,800
7	Marginal wharf 500' x 60', 60' piles, with railway.....	1,160	1,915	14,080
8	Marginal wharf 500' x 60', 80' piles, no railway.....	1,250	2,120	13,600
9	Marginal wharf 500' x 60', 80' piles, with railway.....	1,315	2,210	14,960
10	Wharf approaches 30' wide (per 100 linear feet) no railway.....	103	182	2,050
11	Wharf approaches 30' wide (per 100 linear feet) with railway.....	120	195	2,180

f. Construction Factors for Specific Types of Marginal Lighterage Wharves, per 100 Linear Feet.

1	1	2	3	4
	Type of construction	Short tons	Measure-ment tons	Man-hours
2	Timber pile, 35 feet wide, using 40 foot piles.....	171	228	2,400
3	Timber crib, supporting timber bents, 35 feet wide.....	143	193	2,800
4	Timber retaining wall (Wakefield pile) with earth or rubble fill.....	21	30.5	1,300
5	Steel sheet piling retaining wall with earth or rubble fill.....	27	25	1,100

g. Construction Factors for Floating Pontoon Wharves. Reference—Pontoon Gear Manual, Rev. March 1944, Bureau of Yards and Docks, Dept. of the Navy. A floating wharf suitable for a Victory or Liberty ship berth is 7 pontoons wide by 72 pontoons long, or about 50 by 420 feet. Three approaches, each 4 by 24 pontoons, about 28 by 140 feet, are usually adequate. Total area of wharf and approaches is 32,760 sq. ft. The construction factors are—

1	1	2	3	4
	Floating pontoon wharves	Short tons	Measure-ment tons	Man-hours
2	Per 1,000 square feet.....	42	127	343
3	Wharf and approaches as above, 32,760 square feet.....	1,376	4,160	11,240

h. Construction Details for LST Landings. Top surfaces of landings are 25 feet wide; side slopes 1:4. Landings extending to a depth of 5 feet at low water are adequate except on beaches flatter than 1:50.

258. Dredging

Since dredging is a slow operation, dredging harbors in a military operation should be avoided if possible. Likewise, because of the danger of damaging foundations, plans should not anticipate dredging in the close proximity of quay walls. Generally, demolition debris can be cleared in front of berthing sites by the use of dragline or clam-shell cranes. If dredging of harbor areas is unavoidable the following overall planning factors may be used as a guide. Dredging quantities vary considerably with the type of equipment used, the distance of haul to the spoil area, the method of haul, and the kind of material being excavated (sand, mud, gravel, soft rock or coral, hardrock, etc.).

	1	2	3	4	5
1	Type of dredge	Hydraulic suction ¹	Dipper	Clam shell or orange peel	Sea-going ² hopper
2	Size.....	12"-28" pipe.....	2-16 cubic yards...	1-9 cubic yards....	700-5,000 cubic yards.
3	Operating personnel.	Varies from 12-90 man crews, depending on size of dredge and number of shifts being worked			
4	Operating characteristics and principal use.	Soft digging, river channel dredging.	Clay, rock, or debris excavation.	Dredging in limited areas, caisson work, debris clearance.	Outer harbor work. Spoil area may be several miles away.
5	Maximum swells affecting operations.	3'.....	10'.....	10'.....	Designed for dredging in rough water.
6	Maximum dredging depth (feet).	15'-65'.....	20'-50'.....	10'-60'.....	36'-60'.
7	Average daily capacity ³ (cubic yards.)	5,400 (12")..... 28,000 (28").....	2,000 (2 CY)..... 9,000 (16 CY).....	500 (1 CY)..... 3,000 (9 CY).....	6,500 (700 CY). 10,000 (5,000 CY).

¹ The average distance which this type of dredge pumps to a spoil area is 1,000-3,000 feet. On the Fort Peck Dam the 28" dredge pumped 11,000-31,000 feet.

² Dredges normally require 1 day per week shutdown for maintenance. These figures do not include maintenance delays but do include time consumed in moving the dredge along the cut area.

³ The 700-cubic yard "Hoffman Type" dredge was designed for use in World War II. It is especially useful in cutting a channel across a shoal at a harbor entrance. In a military operation it is probable that all other dredging would be accomplished with local equipment or on-site expedients.

259. General Construction

a. General. This paragraph presents planning factors for engineer materials and man-hours required for construction of facilities in the following categories:

- (1) Troop housing.
 - (2) Headquarters and administration facilities.
 - (3) Hospitals.
 - (4) Depots.
 - (5) Shops.
 - (6) Refrigeration and ice plants.
 - (7) Personnel service buildings, including laundries, dry-cleaning plants, bakeries, recreation facilities and base post offices.
 - (8) POW camps.
- b. *Troop Housing.*
- (1) *Types.* Normally troop units bivouac without assistance, but troop housing is constructed when and as justified. Troop housing facilities are estimated in six types intended for varying degrees of permanence. These types are as follows:
 - (a) *Type 1.* TOE tents—no engineer materials nor assistance.
 - (b) *Type 2.* Class IV tents pitched by using troops—no engineer materials nor assistance.
 - (c) *Type 3.* Frame buildings for administration, bathhouses, infirmaries, storehouse, and kitchens. Class IV tents (with 2" concrete floors in housing only) for all other purposes. Access road stabilized with local materials. Water piped from central storage tank to bathhouses and kitchens. Electric distribution to buildings. Pit latrines.
 - (d) *Type 4.* Frame buildings for all purposes except housing, for which there are class IV, tents with 2" concrete floors and wooden frames. Electric distribution to all facilities. Other utilities same as type 3 above.
 - (e) *Type 5.* Frame buildings for all purposes; otherwise the same as type 4 above.
 - (f) *Type 6.* Frame buildings for all purposes, latrines replaced by plumbing and waterborne sewage (disposal plant not included in estimates); and bituminous surface for access road. Otherwise the same as type 5 above. This type includes all applicable facilities described in TM 5-280.
 - (2) *Material and man-hour requirements for the various types, for camps in the temperate climate, in sizes from 250- to 3,000-man.* Structures will be primarily prefabricated buildings for all climates. Standard framing, T. O. construction based on TM 5-280 will be used as an alternative.

	1	2	3	4	5	6	7	8	9	10	11
1	Type	Size (number men)	Structures, 1,000 square feet		Electric (kva.)	Water M gal/ day	Roads in miles	Site area (acres)	Materials		Man- hours
			Buildings	Tents					Short tons	Measure- ment (tons)	
2	1	Organic tents—No engineer materials nor effort required.									
3	2	Class IV QM tents erected by using service. No engineer materials nor effort required.									
4	3	250	5.4	14.0	5	5.0	0.20	10	78	72	2,700
5		500	12.0	28.0	5	10.0	.20	20	156	133	4,300
6		1,000	24.0	56.0	10	15.0	.25	35	260	217	7,700
7	4	1,500	30.0	83.0	15	22.5	.25	50	361	302	11,990
8		3,000	62.0	166.0	30	45.0	.50	75	733	612	21,300
9		250	11.0	12.0	5	5.0	.40	10	168	171	8,460
10	5	500	22.0	23.0	5	10.0	.40	20	307	321	13,600
11		1,000	41.0	46.0	10	15.0	.50	35	544	561	20,700
12		1,500	54.0	68.0	15	22.5	.50	50	745	755	25,860
13	6	3,000	112.0	136.0	30	45.0	1.00	75	1,522	1,542	52,220
14		250	24.0	0	5	5.0	.40	10	246	270	10,200
15		500	45.0	0	5	10.0	.40	20	441	487	16,900
16	7	1,000	85.0	0	10	15.0	.50	35	843	945	27,400
17		1,500	123.0	0	15	22.5	.50	50	1,225	1,355	36,700
18		3,000	246.0	0	30	45.0	1.00	75	2,472	2,730	72,000
19	8	250	25.0	0	5	6.25	.40	10	288	347	18,000
20		500	47.0	0	5	12.5	.40	20	548	639	26,900
21		1,000	86.0	0	10	25.0	.50	35	951	1,091	38,100
22	9	1,500	123.0	0	15	37.5	.50	50	1,340	1,540	49,590
23		3,000	246.0	0	30	75.0	1.00	75	2,702	3,100	95,700

c. Headquarters and Administration Facilities.

- (1) *Types.* Estimates are based on two types, type 5 and type 6, with specifications the same as for troop housing of these types.
- (2) *Material and man-hour requirements for the above types, for headquarters requiring office space between 10,000 and 50,000 square feet, for various climates.* Structures will be primarily prefabricated buildings for all climates. Standard frame T. O. construction based on TM 5-280 will be used as an alternative.

	1	2	3	4	5	6	7	8	9	10
1	Type	Climate	Size office space (M sq. ft.)	Other space (M sq. ft.)	Elec- tric (kva.)	Water (gpd.)	Roads (miles)	Materials		Man- hours
								Short tons	Meas- ure- ment (tons)	
2	5	Temperate.....	10	5	15	200	0.5	141	150	1,850
3			25	7	30	500	1.0	315	329	17,120
4			50	14	45	1,000	2.0	626	648	33,990
5		Tropic.....	10	5	15	200	.5	121	120	7,800
6			25	7	30	500	1.5	273	267	16,370
7			50	14	45	1,000	2.0	543	524	32,120
8		Frigid.....	10	5	15	200	.5	279	404	14,610
9			25	7	30	500	1.5	597	857	38,490
10			50	14	45	1,000	2.0	1,192	1,712	60,840
11	6	Temperate.....	10	5	15	3,000	.5	203	232	16,765
12			25	7	30	8,000	1.0	442	496	34,510
13			50	14	45	15,000	2.0	878	977	67,330
14		Tropic.....	10	5	15	3,000	.5	181	182	16,415
15			25	7	30	8,000	1.0	400	434	33,760
16			50	14	45	15,000	2.0	795	855	65,860
17		Frigid.....	(Data not available.)							

d. *Hospitals.*

- (1) *Types.* Estimates are based on three types of construction, similar in permanence to troop housing of types 2, 4, and 6, respectively, as follows:
 - (a) *Type 2.* All facilities in organic and class IV tents, hospital tents floored and framed, personnel tents pitched by using troops with no engineer materials nor assistance. Water piped from central storage tank to necessary facilities; roads unimproved; pit latrines.
 - (b) *Type 4.* Buildings for all facilities except hospital wards and personnel housing, for which concrete tent floors and wood tent frames are provided. Facilities include a 1-ton ice plant but no laundries nor refrigerated warehouses. Estimates include stabilized roads, water and electric distribution, plumbing and waterborne sewage, but do not include sewage disposal plant.
 - (c) *Type 6.* Buildings and utilities complete for all facilities, as described in TM 5-280. Bituminous surfaced roads are included.
- (2) *Material and man-hour requirements for 300- to 1,000-bed hospitals of the above types, for various climates and types of buildings.*

(a) *Three-hundred-bed hospital.*

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1	1	2	3	4	5	6	7	8	9	10	11	12			
	Type	Buildings (sq ft)	Tent floors (sq ft)	Electric (kva)	Water (gal. per day)	Roads (miles)	Site area (acres)	Type of buildings	Climate	Materials		Man- hours			
										Short tons	Measure- ment tons				
2	2	-----	41,000	15	15,000	0.5	20	-----	-----	118	85	4,950			
3										4	38,000	32,000	50	30,000	.75	20	Shell-----	{Tropic-----	600	880	34,000
4	{Temperate-----	710	955	34,840											
5		Prefabricated-----	{Tropic-----	656	787	30,694									
6				{Temperate-----	706	868	31,534								
7					Frame-----	{Tropic-----	1,140	1,485	54,200						
8	TOpns-----						{Temperate-----	990	1,350	46,090					
9		Shell-----	{Tropic-----					1,082	1,441	54,150					
10				{Temperate-----				1,191	1,605	56,000					
11					6	85,000		-----	100	30,000	.75	20	Prefabricated-----	{Tropic-----	1,184
12	{Temperate-----						1,182								1,375
13		Frame-----	{Tropic-----				1,870								2,437	88,600
14				{Temperate-----			1,655								2,269	78,120
15					TOpns-----	{Frigid-----	2,165	2,917	90,000						

(b) *Four-hundred-bed hospital.*

	1	2	3	4	5	6	7	8	9	10	11	12
1	Type	Buildings (sq ft)	Tent floors (sq ft)	Electric (kva)	Water (gal. per day)	Roads (miles)	Site area (acres)	Type of buildings	Climate	Materials		Man- hours
										Short tons	Measure- ment tons	
2	2	-----	45,000	50	20,000	0.75	25	Shell.....	Tropic.....	133	122	7,290
3										4	51,000	37,000
4	6	-----	200	40,000	1.0	25	Frame.....	Temperate.....	821			
5									8	-----	200	40,000
6	10	-----	200	40,000	1.0	25	Shell.....	Temperate.....				
7									12	-----	200	40,000
8	14	-----	200	40,000	1.0	25	TOpns.....	Temperate.....				
9									16	-----	200	40,000
10	18	-----	200	40,000	1.0	25	Frame.....	Temperate.....				
11									20	-----	200	40,000
12	22	-----	200	40,000	1.0	25	Frame.....	Temperate.....				
13									24	-----	200	40,000
14	26	-----	200	40,000	1.0	25	Frame.....	Temperate.....				
15									28	-----	200	40,000

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(c) Five-hundred-bed hospital.

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1	1	2	3	4	5	6	7	8	9	10	11	12
	Type	Buildings (sq ft)	Tent floors (sq ft)	Electric (kva)	Water (gal. per day)	Roads (miles)	Site area (acres)	Type of buildings	Climate	Materials		Man- hours
										Short tons	Measure- ment tons	
2	2	-----	60,000	50	25,000	0.75	30	-----	-----	178	132	8,000
3	4	54,000	51,000	100	50,000	1.0	30	Shell.....	Tropical.....	905	1,150	45,350
4								-----	Temperate.....	990	1,281	47,000
5								Prefabricated.....	Tropical.....	959	1,156	41,410
6								-----	Temperate.....	969	1,109	41,900
7								Frame.....	Tropical.....	1,526	2,140	68,720
8								TOpns.....	Temperate.....	1,418	1,970	63,800
9	6	124,000	-----	200	50,000	1.0	30	Shell.....	Tropical.....	1,644	2,246	77,115
10								-----	Temperate.....	1,827	2,488	80,000
11								Prefabricated.....	Tropical.....	1,768	2,258	67,935
12								-----	Temperate.....	1,815	2,153	69,200
13								Frame.....	Tropical.....	2,766	3,658	125,390
14								TOpns.....	Temperate.....	2,599	3,578	111,230
15								-----	Frigid.....	3,191	4,377	128,915

(d) One-thousand-bed hospital.

	1	2	3	4	5	6	7	8	9	10	11	12
	Type	Buildings (sq ft)	Tent floors (sq ft)	Electric (kva)	Water (gal. per day)	Roads (miles)	Site area (acres)	Type of buildings	Climate	Materials		Man- hours (in thou- sands)
										Short tons	Measure- ment tons	
2	2	-----	125,000	50	50,000	1.0	50	-----	-----	322	264	10.54
3	4	93,000	104,000	150	100,000	1.5	50	Shell.....	Tropic.....	1,400	1,824	66.0
4								-----	Temperate.....	1,610	2,004	68.2
5								Prefabricated.....	Tropic.....	1,583	1,762	59.2
6								-----	Temperate.....	1,600	1,753	67.3
7								Frame.....	Tropic.....	2,519	3,392	101.6
8								TOpns.....	Temperate.....	2,344	3,150	94.5
9	6	226,000	-----	250	100,000	1.5	50	Shell.....	Tropic.....	2,616	3,478	116.0
10								-----	Temperate.....	2,009	3,918	121.2
11								Prefabricated.....	Tropic.....	2,844	3,501	90.4
12								-----	Temperate.....	2,886	3,303	101.4
13								Frame.....	Tropic.....	4,431	5,850	204.6
14								TOpns.....	Temperate.....	4,223	5,820	171.3
15								-----	Frigid.....	5,191	7,110	249.0

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e. Depots.

- (1) *Types.* Estimates are based on three types of construction for general depots and two types for ammunition storage, similar in permanence to troop housing of the same type numbers, as follows:

(a) General depots.

1. *Type 2.* Class IV tents for all facilities requiring cover. Open storage cleared and graded. Roads graded but not improved.
2. *Type 3.* Sheds for covered storage; class IV tents with floors for administrative areas; without floors for other facilities requiring cover. Roads stabilized. Railroad sidings to open storage areas.
3. *Type 5.* Closed buildings for covered storage and administrative facilities. Bituminous surfaced main access roads to covered and open storage areas; other interior roads stabilized. Railroad sidings to storage areas.

(b) Ammunition storage.

1. *Type 2.* Class IV tent for 10 percent of the ammunition tonnage and for administrative facilities. Open storage areas cleared and graded. Access roads graded but not improved.
2. *Type 3.* Sheds for 10 percent of the ammunition tonnage. Buildings for administrative facilities. Access roads and parts of open storage areas stabilized with local materials. Railroad sidings to storage areas.

- (2) *Material and man-hour requirements* for depot construction of the above types.

(a) Covered storage in general depots.

	1	2	3	4	5	6	7	8	9	10	11	12
1	Type	Nominal size of depot (M sq ft)	Structures			Electricity (kva)	Roads (miles)	Railroads (miles)	Site area (acres)	Materials		Man-hours (thousands)
			Tents (M sq ft)	Open side (M sq ft)	Closed side (M sq ft)					Short tons	Measure (tons)	
2	2	100	103.5				0.5		9	2	2	2.0
3	3		3.5	100	1.1	30	.5		9	208	223	11.0
4	5				127.4	37	.5	0.5	9	1,016	930	34.9
5	2	250	258				2.0		20	9	9	7.0
6	3		8	249.8	5.4	85	2.0		20	643	643	33.1
7	5				262.8	85	2.0	1.3	20	2,348	2,220	97.4
8	2	500	515				4.0		40	18	18	13.9
9	3		15	499.5	5.4	150	4.0		40	1,100	1,165	70.8
10	5				527.5	150	4.0	2.5	40	3,623	3,770	182.2

(b) *Open storage in general depots.*

	1	2	3	4	5	6	7	8
1	Type	Nominal size of depot (M sq ft) (open storage)	Roads (miles)	Railroads (miles)	Site area (acres)	Materials		Man-hours (thousands)
						Short tons	Measurement (tons)	
2	2	100	0.3	-----	5	1	1	1.86
3	3		.2	0.6	5	232	183	8.00
4	5		.3	.6	5	239	196	9.48
5	2	500	1.5	-----	25	8	8	6.42
6	3		1.5	3.0	25	1,123	867	35.67
7	5		1.5	3.0	25	1,177	945	43.67
8	2	1,000	3.0	-----	51	14	14	12.68
9	3		3.0	6.0	51	2,220	1,734	71.2
10	5		3.0	6.0	51	2,353	1,886	84.60

(c) *Ammunition storage.*

	1	2	3	4	5	6	7	8	9	10	11
1	Type	Depot capacity (tons/day)	Structures		Open storage acres	Roads (miles)	Railroad (miles)	Site area (acres)	Materials		Man-hours (thousands)
			Tents (sq ft)	Buildings (sq ft)					Short tons	Measurement tons	
2	2	600			0.2	0.15		80	1	1	0.08
3	2	18,000	4,500		8.25	4.5		2,340	25	24	14.9
4	3			6,600	8.25	4.5	0.6	2,340	302	253	41.1
5	2	60,000	19,500		27.5	15		7,800	84	80	49.7
6	3			20,520	27.5	15	2.0	7,800	1,004	842	137.4
7	2	40,000	78,000		.110	.60		31,200	335	319	198.9
8	3			77,760	110	60	8.0	31,200	3,993	3,334	549.1

f. *Shops.*

- (1) *Covered shop requirements* in square feet of floor area for various service units.

	1	2	3
	Service	Unit	Square feet
2	Chemical.....	Depot Company (Comm. 2).....	1,000
		Decontamination company.....	800
		Laboratory.....	5,200
		Processing company, M2 plant.....	7,500
		Maintenance company.....	4,600
3	Engineer.....	Gas Generator team.....	2,000
		Foundry team.....	2,500
		Field maintenance company.....	9,000
4	Ordnance.....	Medium automotive maintenance company.....	25,000
		Heavy automotive maintenance company.....	40,000
		Base armament maintenance battalion.....	100,000
		Base automotive maintenance battalion.....	100,000
		Heavy maintenance company, field army.....	30,000
		Medium maintenance company.....	20,000
		Tire repair company.....	16,000
		Motor vehicle distributing company.....	12,000
		Motor vehicle assembly company.....	20,000
5	Signal.....	Base maintenance company.....	50,000
6	Transportation.....	Railway operating battalion.....	8,000

(2) *Material and man-hour requirements for various standard buildings suitable for shops.*

	1	2	3	4	5	6	7	8	9	10
	Type of building	T'Ops No.*	Floor area (square feet)	Electric (kva.)	Water (M gallons per day)	Roads (miles)	Hard standings (square yards)	Materials		Man-hours (thousands)
								Short tons	Measurement (tons)	
2	Rigid frame.....	11.44.....	3,000	15	0.2	.05	100	53	59	2.4
3	Rigid frame.....	11.21.....	5,400	15	.5	.5	200	69	68	3.0
4	Rigid frame.....	11.26A.....	16,900	50	1.8	.16	625	238	212	9.1
5	Shell.....	211.71.....	2,400	10	.2	.5	100	55	46	1.6
6	Navy rigid frame.....	Utility.....	4,000	10	.2	.5	100	62	53	4.8

* Plans and specifications published in TM 5-280.

g. Ice Plants and Refrigerated Storage.

- (1) Each man will require a minimum of 2.50 cubic feet or a maximum of 5 cubic feet of refrigerated storage per month of supply.
- (2) Ice requirements are 2 pounds per day in the Temperate and Tropical zones. None is required in the Arctic zone.

	1	2	3	4	5	6	7	8
1	Facility	T Opns building No.*	Capacity		Building area (square feet)	Construction materials		Man- hours
			Tons/day	Cnblc feet		Short tons	Measure- ment tons	
2	Ice plant.....	27.11	1.0	-----	550	22	39	1,250
3	Ice plant.....	27.6	3.6	-----	1,040	50	90	2,250
4	Ice plant.....	27.7	15.0	-----	2,080	132	226	2,650
5	Refrigerated warehouse.....	27.5	-----	12,700	2,000	71	118	1,650
6	Refrigerated warehouse.....	27.13	-----	150,000	16,000	800	1,500	20,200

* Plans and specifications published in TM 5-280.

h. Personnel Service Facilities. Material and Man-Hour Requirements for Buildings.

	1	2	3	4	5	6	7	8
1	Building	Description	Climate	T Opns No. ¹	Area (square feet)	Materials		Man hours
						Short tons	Measure- ment (tons)	
2	10,000 man..	Laundry and boilerhouse ² ..	Temperate and tropic..	25.20	9,350	225	259	7,400
3	10,000 man..	Laundry and boilerhouse..	Frigid.....	125.21	9,350	144	168	6,100
4	5,000 man..	Laundry and boilerhouse..	Temperate and tropic..	25.15	6,400	138	158	4,200
5	5,000 man..	Laundry and boilerhouse..	Frigid.....	125.16	6,400	103	115	3,300
6	5,000 man..	Dry cleaning plant and boilerhouse.	Temperate and tropic..	25.37	2,960	48	48	1,400
7	5,000 man..	Dry cleaning plant and boilerhouse.	Frigid.....	25.37	2,960	64	111	1,400
8	2,500 man..	Dry cleaning plant and boilerhouse.	Temperate and tropic..	25.36	1,900	27	31	980
9	2,500 man..	Dry cleaning plant and boilerhouse.	Frigid.....	25.36	1,900	27	33	1,000
10	Mohlle.....	Bakery building ⁴	Temperate and tropic..	211.71	10,000	96	79	1,970
11	Mobile.....	Bakery building ⁴	Frigid.....	116.8	10,000	199	251	6,600
12	Floor space for special service or base P. O. facilities. ^{4,7,8}		Temperate and tropic..	211.71	100,000	800	818	18,400
13	Floor space for special service or base P. O. facilities.		Frigid.....	111.2	100,000	1,768	2,580	65,200

¹ Troop laundries and dry-cleaning plants are rigid frame T Opns construction and for planning purposes two sizes of each facility are shown in the tables.

² Laundries and dry-cleaning plants are to furnish all the normal cleaning needs of 100,000 men. Sufficient facilities are provided so that these needs normally can be accomplished in a 16-hour day, 6 days per week. This allows an extra shift per day plus an extra day per week for abnormal conditions.

³ A processing company is equipped with two plants (M1 or M2); when operated from a semifixed installation each plant is capable of processing 3,000-4,000 pounds (500-650 uniforms) per day. Two efficient plants (one company) can process 10,000 pounds in 24 hours. Chemical processing units usually operate in conjunction with quartermaster laundry units. The M1 plant is a substitute for the M2 plant. Operating capacities of the M1 and M2 plants are approximately equal.

⁴ Shell buildings.

⁵ The QM mobile bakery requires building space to house its equipment when operating for an extended period of time in one location.

⁶ Bakeries will be required to produce 46,000 pounds daily and facilities are provided to accomplish this in 18 operating hours each day, every day. The extra 6 hours per day are intended to be used for unforeseen or special requirements.

⁷ Recreation facilities for special service activities in the communications zone require building space estimated at 11 square feet per man in the communications zone.

⁸ Base post offices require building space estimated at 0.35 square feet per man in the theater.

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i. POW Camps.

- (1) *Types.* Estimates are based on two types, types 2 and 3, of permanence similar to troop housing of these types and described as follows:
 - (a) *Type 2.* Class IV tents for POW housing. Engineer construction consists in the security fences, lighting and guard towers, and in water piping to the central inclosure. Waste disposal is by pit latrine.
 - (b) *Type 3.* Facilities comparable with those for type 3 troop housing, with modifications as required for security, and specifically including fences, lighting and guard towers.
- (2) *Material and man-hour requirements.*

Type	Size (num- ber of POWs)	Structures		Elec- tric (kva.)	Water (M gallons per day)	Fence (M linear feet)	Roads (miles)	Site area (acres) (10 M square yards)	Materials		Man- hours (thou- sands)
		Build- ings (M square feet)	Tents (M square feet)						Short tons	Meas- urement (tons)	
2	500	-----	25	10	WP	4	0.2	4.84	39	53	3.5
	20,000	-----	1,000	300	60	44	2.0	108.90	414	511	37.6
3	500	2.7	20	10	5	4	.2	4.84	83	125	6.3
	20,000	71.3	644.4	400	200	44	2.0	108.90	1,861	3,868	104.3

j. Bivouacs, Camps and Billets.

- (1) *Bivouac areas.* The bivouac area of a regimental combat team will vary from 50 acres to 1 square mile, as indicated by the situation and in proportion to the dispersion necessary and to the amount of concealment and cover available. The approximate minimum area required by a unit may be estimated as indicated in (2) below where personnel is the consideration, or on the following basis where the number of vehicles with the unit should govern (the larger areas determined by the two methods will be used): Take the square root of the number of vehicles with the unit, multiply by the desired dispersion in yards; this will give the dimensions in yards of a square area required to accommodate the unit.
Example: Assume that a regimental combat team has 350 vehicles, and a dispersion of 100 yards between vehicles is desired. Square root of 350 is approximately 19. 19 times 100 equals 1,900 yards, which is the length of a side of the square required, or approximately $\frac{1,900}{70} \times \frac{1,900}{70} = 737$ acres. Personnel will be distributed throughout the area.

(This will vary with the type of warfare and the type of terrain.)

Note. The number of acres in a rectangular tract is approximately equal to the product of one-seventieth of the length in yards by one-seventieth of the breadth in yards. One acre equals 4,840 square yards (about 70 yards square). 1 square mile equals 640 acres.

- (2) *Tent camps—capacity.* Large pyramidal tent, normal assignment—6-8 men per tent; area required for regimental combat team camp (open ground) approximately—50 acres; estimate of area required—50 square yards per man; 100 square yards per vehicle.

(3) *Data on tentage.*

1	1		2	3	4	5	6
	Data on Tentage		Surface area (square ft)	Floor space (square ft)	Vertical wall (height)	Weight in pounds per unit (packed)	Cubage per unit (packed)
	Type	Dimensions					
2	Assembly.....	40 ft. x 80 ft.....	4,965	2,860	8 ft. 0 in.....	1,000	34.35
3	Command post....	11 ft. 10 in. x 7 ft. 6 in....	328	90	6 ft. 2 in.....	114	6.8
4	Hospital ward....	50 ft. x 16 ft.....	2,162	800	4 ft. 6 in.....	395	19.8
5	Pyramidal.....	16 ft. x 16 ft.....	396	256	3 ft. 0 in.....	133	6.0
6	Storage.....	17 ft. 10 in. x 20 ft. 5 in....	1,008	364	5 ft. 2 in.....	210	6.5
7	Wall, large.....	14 ft. 6 in. x 14 ft. 4 in....	570	210	4 ft. 6 in.....	152	6.1
8	Wall, small.....	18 ft. 10 in. x 9 ft. 2 in....	492	168	3 ft. 9 in.....	57	2.7
9	Paulin, large....	20 ft. x 40 ft.....	800			160	4.2
10	Paulin, small....	12 ft. x 17 ft.....	204			57	2.3
11	Screen, latrine...	8 ft. x 52 ft.....	416			45	1.1
12	Squad*.....	16 ft. x 32 ft. 7.5 in.....	886	522	4 ft. 9 in.....	474	18.5
13	Gen. purp. med..	16 ft. x 32 ft. 8 in.....		523	5 ft. 6 in.....		

*Limited standard, will be replaced by medium tent, general purpose as stocks are depleted.

(4) *Space allowances for quarters* under Theater of Operations conditions:

(a) *Normal.* 40 square feet floor space and 400 cubic feet air space per person.

(b) *Emergency.* 50 percent of the above.

(5) *Billets.* In hostile or liberated territory the capacity of a locality for billeting is approximately as follows:

Rich farming country..... 5 per inhabitant.
 Cities..... 2 per inhabitant.
 Average American city..... 20 per vacant dwelling.
 Vacant buildings and dwellings in average city (civilians may be caused to move to vacancies in order to concentrate military activities). 10 percent of population.

With civilians furnishing subsistence. 10 percent of population for 1 week.

k. Housing Requirements in Addition to Troop Camps. In addition to those troop housing facilities provided for normal functions of troops, it is usually necessary to provide additional installations based upon the following percentages of the theater population.

1	1	2
	Facility	Percentage of theater troops
2	Recreation center.....	5% of total.
3	Rehabilitation Center.....	2% of total.
4	Reception center.....	5% of total.
5	Replacement depot.....	3% of total.
6	Casual camp.....	1% of total.
7	Ground troop training center.....	5% of all ground forces.
8	Service force training center.....	5% of all service troops.
9	Labor camp.....	5% of prewar population in area.
10	Temporary refuge for displaced persons.....	5% of prewar population in area.
11	Military prisoners.....	1% of total.
12	Undesirable civilians (saboteurs, etc.).....	5% of prewar population in area.

l. Office Space. Space allowances for offices under Theater of Operations conditions: 60 square feet per person employed, plus 10 square feet per drafting board.

m. Shell, Prefabricated, and Standard Frame Buildings.

- (1) The shell building TOpns 211.71 (with dimensions of 20' x 54') consists of precut wooden framing, with the roof and part of the sides covered with corrugated steel sheets. All the material for the 20' x 54' building is shipped in a single package. The length may be changed by the addition or omission of 9' intermediate bays. The width may be increased to 46' by modifying the heights of the posts, and the roof system. Partial insulation can be obtained by closing the sides and using a special kit; and complete insulation with additional sidewall materials. A 2-inch concrete floor is laid if required. This type is suitable for temperate and tropical climates.
- (2) The shell building TOpns 211.75 (with dimensions of 110' by 405') consists of precut wooden framing with a corrugated steel roof and open sides. It is shipped in 31 packages. If required, the sides are closed and a concrete floor laid. This building is used primarily for depot storage.
- (3) Barrack, portable, prefabricated steel angle frame, TOpns 211.59 and TOpns 111.61, (with dimensions of 20' x 48') is

the basic unit for prefabricated construction. This building can be modified and expanded by the addition of 20' x 8' units. These units are designated as window unit "B", and door unit "C", respectively. These buildings are normally used only in hospital construction; TOPns 111.61 in temperate climates, and TOPns 211.59 in tropic climates.

- (4) Standard frame buildings are constructed in various dimensions and designs from standard materials listed in TM 5-280. Because of the large lumber and man-hours requirements involved, this construction is normally restricted to special purpose buildings such as refrigerated warehouses, ice plants, laundries, dry cleaning plants, special shops, and facilities for frigid climates.

260. Bulk Petroleum Storage and Distribution

a. General. See paragraphs 92 through 102 for petroleum requirements; paragraph 93 for types and capacity of carriers in general use; and paragraph 184 for types and capacity of pipelines. See TM 5-350 for descriptions and operating characteristics of pipeline equipment and AR 701-9100-1 for responsibilities. A pipeline system includes all necessary pipe, fittings, pump stations, tanks and dispensing facilities, complete and in operating condition.

b. Tanks. Capacity, dimensions, weight, and cubage of standard bolted steel tank sets are given in the table below. All the valves, pipe fittings, and pipe necessary to connect the tank to the tank farm trunk line or pump station is included in the weight and cubage. The tank sheets and other material is crated or bundled ready for shipment by land, sea, or air. The 10,000- and 42,000-gallon tank sets are provided with 6" valves, fittings, and 1,700 feet of victaulic coupled 6" pipe and couplings. The 420,000-gallon tank sets contain 8" valves, fittings and 1,600 feet of 8" victaulic coupled pipe and couplings. See paragraph 93 for the "pillow" type portable fabric tank.

	1	2	3	4	5	6
1	Set No.	Capacity (gal)	Diameter	Height	Weight crated (lbs)	Cubic feet crated
2	890-01.....	10,000	15'-4½"	8'-1½"	23,931	840
3	890-02.....	42,000	21'-6¾"	16'-1"	32,734	989
4	890-04.....	420,000	54'-11½"	24'-1½"	106,127	3,178

c. Pipelines. The 6-inch, 13.92 pounds per foot, grooved ends for couplings, pipe is standard for military pipeline systems, however, 4 inch, 9.32 pounds per foot grooved end pipe is used for special purposes, such as a small isolated air strip or fuel dump. Eight-inch and larger pipe is used to rehabilitate civil systems and tank farm headers. Submarine ship-to-shore lines are 8-inch in order to unload a tanker as quickly as possible.

	1	2	3	4
1	Pipe (diam in.)	Gallons per 20-hour day	Net short tons per day motor gaso-line	Short tons per day after packaging in 5-gallon drums
2	6.....	600,000	1,842	2,445
3	4.....	288,000	883	1,055

d. Construction Rates. Pipeline and bulk storage facilities are constructed only by specially trained troops such as the engineer pipeline company, except that about 50 percent of a force employed on such construction can be given work which does not require special training. For planning purposes, the construction to be assigned to one engineer pipeline company or platoon, including the hauling of the materials an average distance of 50 miles, is as follows:

	1	2	3
1	Item	Unit	Construction rate
2	6" pipeline system, complete pump station construction..	Company..... Platoon*.....	4 mi./day. 1 in 7 days.
3	Tank erection: 42,000 gallons.....	Platoon.....	1 in 2 days.
4	420,000 gallons.....	Platoon.....	1 in 7 days.

*Four per company.

e. Pipeline Operation. The standard 6-inch pipeline, when pumped at a rate of 500 gallons per minute (600,000 gals. per 20-hr. day) requires pump stations at 16-mile intervals on level ground. The engineer petroleum distribution company is organized to operate 10 such pump stations and appurtenant facilities. A battalion of four

such companies normally operates 600 miles or more of pipeline; or, within its capacities it carries out construction and operation simultaneously (TM 5-350).

f. Pipeline Communications. A pipeline system requires a continuous and exclusive system of wire communication, with a minimum of two circuits from the headquarters or terminal to each pump station, tank farm and dispensing point. Telephones are used on short lines; teletype for lines 100 miles or more in length. However, on long lines teletype equipment is required in only about every fifth pump station.

g. Tank Farms. Construction factors for tank farms of various size, designed for one or three petroleum products using the 10,500—42,000 and 420,000, gallon standard bolted, steel tank sets are as follows:

	1	2	3	4	5	6	7	8	9	10
1	Size of tanks (gals)	No. of tanks	Materials				Labor man-hours			Site area 10 M sq yds
			Weight of each tank includes; tank plates, valves, fittings and 1,600 feet of pipe				Erection includes the tank, manifold, assembled and pipe laid to trunk line, fire walls and roads in tank farm			
			Weight per tank (short ton)	Total short tons	Measured tons per tank	Total measured tons	Erection and manifold	Clear grade	Total man-hours	
210,000 gallons or 5,000 barrels tank farm designed to handle 3 products*										
2	42,000.....	6	20	120	32	192	9,000	1,950	10,950	5.81
210,000 gallons or 5,000 barrels tank farm designed to handle 1 product only										
3	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
630,000 gallons or 15,000 barrels tank farm designed to handle 3 products*										
4	42,000.....	6	20	120	32	192	9,000	1,950	10,950	5.81
5	420,000.....	1	53	53	79	79	4,500	375	4,875	.97
6	Total.....	7	-----	173	-----	271	13,500	2,325	15,825	6.78

680,000 gallons or 16,000 barrels tank farm designed to handle 1 product only

7	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
8	420,000.....	1	53	53	79	79	4,500	375	4,875	.97
9	Total.....	6		153		239	12,000	2,000	14,000	5.81

2,310,000 gallons or 58,000 barrels tank farm designed to handle 3 products*

10	42,000.....	3	20	60	32	90	4,500	975	5,475	4.84
11	420,000.....	6	53	318	79	474	27,000	2,250	29,250	1.94
12	Total.....	9		378		570	31,500	3,225	34,725	6.78

2,310,000 gallons or 58,000 barrels tank farm designed to handle 1 product only

13	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
14	420,000.....	5	53	265	79	395	22,500	1,875	24,375	4.84
15	Total.....	10		365		555	30,000	3,500	33,500	9.68

4,400,000 gallons or 100,000 barrels tank farm designed to handle 3 products*

16	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
17	420,000.....	10	53	530	79	790	45,000	3,750	48,750	9.68
18	Total.....	15		630		950	52,500	5,375	57,875	14.52

See footnote at end of table.

	1	2	3	4	5	6	7	8	9	10
1	Size of tanks (gals)	No. of tanks	Materials				Labor man-hours			Site area 10 M sq yds
			Weight of each tank includes; tank plates, valves, fittings and 1,600 feet of pipe				Erection includes the tank, manifold, assembled and pipe laid to trunk line, fire walls and roads in tank farm			
			Weight per tank (short ton)	Total short tons	Measured tons per tank	Total measured tons	Erection and manifold	Cleargrade	Total man-hours	
4,200,000 gallons or 100,000 barrels tank farm designed to handle 1 product only										
19	420,000.....	10	53	530	79	790	45,000	3,750	48,750	9.68
6,510,000 gallons or 155,000 barrels tank farm designed to handle 3 products*										
20	42,000.....	8	20	160	32	256	12,000	2,600	14,600	7.74
21	420,000.....	16	53	848	79	1,264	72,000	5,000	77,000	15.48
22	Total.....	24	-----	1,008	-----	1,520	84,000	7,600	91,600	23.22
6,510,000 gallons or 155,000 barrels tank farm designed to handle 1 product only										
23	42,000.....	5	20	100	32	160	7,500	1,625	9,125	4.84
24	420,000.....	15	53	795	79	1,185	67,500	5,625	73,125	14.52
25	Total.....	20	-----	895	-----	1,345	75,000	7,250	82,250	19.36

*Products stored by type of product—60 percent Mogas, 35 percent Avgas, 5 percent diesel.

261. Airfield Construction

a. *Construction Effort Required for Airfields in a Theater of Operations.* This section is useful for broad planning purposes only. For oversea theaters it provides estimates for computing Engineer support required to construct U. S. Air Force installations. None of the factors in this section are suitable for the detailed planning required for construction of specific installations. Reference should be made to AFM 400-5 for more detailed planning data.

- (1) The table below gives the number of aviation engineer battalion months required to accomplish the full and minimum operational construction of different types bases. The time requirements are shown separately for new and reconstructed bases. These are average factors applicable to average combat, climatic, transportation, etc., conditions.

	1	2	3	4	5
1	Type base ^a	New base		Reconstructed base ^b	
		Full operational	Minimum operational	Full operational	Minimum operational
2	Strategic:				
3	Heavy bomber (2 wings).....	32	18	25	13
4	Heavy bomber (1 wing).....	18	11	13	7
5	Medium bomber (2 wings).....	16	10	12	6
6	Medium bomber (1 wing).....	10	6	7	4
7	Tactical:				
8	Light bomber or composite (2 wings).....	6	3.5	4	2.5
9	Light bomber (1 wing).....	4	2.5	3	1.5
10	Fighter (Jet-1 wing).....	4	2.5	3	2
11	Fighter (Jet-1 sq).....	2.5	1.8	2	1.3
12	Fighter (Jet-1 sq w/wg hq, or 2 sqs).....	3	2	2.5	1.5
13	Fighter (Recep*-1 sq).....	2	2	2.5	1.5
14	Fighter (Recep*-1 sq).....	2	1.5	1.5	.8
15	Fighter (Recep*-1 sq w/wg hq, or 2 sqs).....	2.5	1.5	2	1
16	Tactical Support advanced airfields:				
17	Fighter-bomber (Jet-1 sq).....	2.5	1	1.3	.8
18	Fighter-bomber (Jet-1 sq).....	1	.7	.8	.5
19	Fighter-bomber (Recep*-1 sq).....	1.5	.8	1	.5
20	Fighter-bomber.....	.8	.4	.5	.3
21	Troop carrier.....	.4	.2	.3	.1
22	Cargo.....	.6	.3	.35	.2
23	Troop carrier:				
24	(2 wgs).....	5	3	3.5	2
25	(1 sq).....	3.5	2.5	3	1.5
26	MATS:				
27	(Route base, small).....	3	1.5	2	1
28	(Route base, large).....	4	2	3	1.5
29	(Terminal, small).....	5	3	4	2
30	(Terminal, large).....	7	4	5	3
31	Air depot:				
32	(Using existing runway).....	6	4	5	3
33	(Runway included).....	8	5	6	4

See footnotes on following page.

NOTES

*Reciprocating type engines.

* General base requirements:

- (1) HB (B-36B and D without jet pods at 326,000 pounds gross takeoff weight and B-36D with jet pods at 357,000 pounds gross take-off weight). Average runway 250' x 9,000' with 144,000 pounds single gear load. Bulk avgas storage of 25,000 barrels per group.
- (2) MB—conventional (B-29/50 at 173,000 pounds gtw). Average runway 170' x 9,300' with 76,500 pounds single gear load. Bulk avgas storage of 25,000 barrels per group.
- (3) MB—Jet (B-47 at 185,000 pounds gtw). Average runway 170' x 8,300' (takeoffs with 20,000 pounds JATO) with 85,000 pounds single gear load. Bulk fuel storage of 60,000 barrels per group or 20,000 barrels per separate squadron.
- (4) LB—conventional (B-26 at 38,000 pounds gtw). Average runway 130' x 7,900' with 17,100 pounds single gear load. Runway for a composite air base (combined base for one wing ea of LB and F, TC, MATS, or Depot, etc.) to be constructed to highest specifications required by any type aircraft to be operated from it. Bulk avgas storage of 15,000 bbls. per LB group.
- (5) LB—Jet (B-45C at 113,000 pounds gtw). Average runway 170' x 9,600' (takeoff with 8,000 pounds JATO) with 50,000 pounds single gear load. Bulk fuel storage of 60,000 bbls. per group or 20,000 barrels per separate squadron.
- (6) Fighter (reciprocating engine) (F-47N standard). Average runway 130' x 8,500' with 9,000 pounds single gear load. Bulk avgas storage of 15,000 barrels per group or 5,000 barrels per separate squadron.
- (7) Fighter (Jet) (F-84E standard at 18,170 pounds gtw (basic mission) or 22,000 pounds gtw (escort mission) w/2,000 lbs. JATO). Average runway 130' x 9,000' with 9,000 pounds single gear load. Bulk fuel storage of 15,000 barrels per group or 5,000 barrels per separate squadron.
- (8) Tactical support Fighter-Bomber (Jet) (F-84E standard at approximately 19,000 pounds gtw). Average runway 110' x 9,000' (emergency standard—25 percent safety factor) with 8,000 pounds single gear load bearing capacity and with temporary type surfacing. Avgas on-base operating storage of 6,000 barrels per group or 2,000 barrels per separate squadron (3 complete refuelings) is desirable but initial operations will be supplied directly from trailer refueling units and from emergency drum or portable storage tank stocks.
- (9) Tactical Support Fighter-Bomber (reciprocating engine). (F-47N standard at 20,867 pounds gtw). Average runway 110' x 6,500' (emergency standard—25 percent safety factor) with 8,000 pounds single gear load bearing capacity and with temporary type surfacing. Avgas on-base operating storage of 6,000 barrels per group or 2,000 barrels per separate squadron (3 complete refuelings) is desirable but initial operations will be supplied directly from refueling units and from emergency drum or portable tank stocks.
- (10) Tactical Support Troop Carrier and Cargo (C-54, C-82, C-119 at 74,000 pounds gtw). Average runway 140' x 5,500' with 35,000 pounds single gear load bearing capacity with temporary type surfacing. No on-base avgas bulk storage required for initial operations. Ultimate storage requirement will be based on subsequent utilization of base.
- (11) Troop Carrier (C-119 at 74,000 pounds gtw, C-82, C-122, C-125). Average runway 170' x 5,700' with 35,000 pounds single gear load. Bulk avgas storage of 10,000 barrels per group.
- (12) MATS Route Base, Small (C-54 longest runway; C-119 largest type A/C at 74,000 pounds gtw). Average runway 170' x 5,700' with 35,000 pounds single gear load. Bulk avgas storage of 5,000 barrels.
- (13) MATS Route Base, Large (C-124 largest type A/C at 210,000 pounds gtw, C-74, C-97). Average runway 350' x 11,000' with 100,000 pounds single gear load. Bulk avgas storage of 20,000 barrels.
- (14) MATS Terminal Small (C-97 largest type aircraft at 150,000 pounds gtw). Average runway 250' x 8,700' with 85,000 pounds single gear load. Bulk avgas storage of 20,000 barrels.
- (15) MATS Terminal, Large (C-124 largest type A/C at 210,000 pounds gtw). Average runway 250' x 110,000 pounds single gear loads. Bulk avgas storage of 25,000 barrels.
- (16) Air Depot. Average runway 170' x 7,000' with 60,000 pounds single gear load. Bulk avgas storage of 10,000 barrels.

^b A reconstructed base makes use of a site where an airfield of some type does exist or has existed. A general factor of 75 percent of total construction of a new base is used to estimate the average construction required to reconstruct an existing base.

- (2) The characteristics given in the footnotes of above table represent requirements for average TO air bases as they will probably be constructed by aviation engineer troops. Runway lengths are based essentially on a minimum operational standard and are adjusted to requirements under expected average conditions of elevation and temperature, which for purposes of these criteria have been assumed to be approxi-

mately 1,000 feet and 80° F. All other facilities are based generally on full operational standard. Facilities on tactical support advanced airfields are limited by the urgent and temporary requirement for such installations, to an approximation of emergency operational requirements for standard tactical bases. Subsequent improvement of these tactical support airfields into standard air bases will require additional construction commensurate with that required to reconstruct an existing base. Pavement bearing capacity requirements are expressed in single main gear loads (45% of gross loadings) of the heaviest standard types aircraft operating from the respective type bases. Bulk avgas storage requirements are given as the average operating storage to be constructed on-base by aviation engineer units and represents generally a 15-day level.

- (3) The number of aviation engineer battalion months required to construct the different type bases is calculated from the man-hour workload needed to build each base. This is determined by specifying for each type base the kinds and numbers of facilities required for the performance of the function of the units supported by the base; i. e., AACs station, housing, runway, etc. Each of these facilities is then broken down into the kinds and number of elements composing it; i. e., paved surfaces, shops, mess halls, and latrines. A man-hour factor, such as 1.45 man-hours per square yard of paved surface, is then applied to each of these elements to compute the total man-hours required to construct each element. The number of man-hours for all elements are then added together to give the total man-hours required to construct the base. This man-hour total is then converted to aviation engineer battalion months by the factor; 110,000 man-hours of construction is equivalent to 1 engineer aviation battalion month.

b. Typical Engineer Force Required for the Construction of U. S. Air Force Installations in a Theater of Operations. In order to compute manning, training, and equipping requirements, it is necessary to convert engineer battalion months as given above to engineer aviation battalions. Thus, a construction task requiring 8 engineer battalion months can be accomplished by 1 engineer battalion working for 8 months, 2 engineer battalions for 4 months, or 4 engineer battalions for 2 months, etc. Obviously, under extreme emergency conditions, one would like to construct as complex an installation as a heavy bomber base in a matter of days. Theoretically this could be done by concentrating enough battalions in the area to perform the required

number of months of construction. However, the effect of oversaturation comes into play, and the efficiency of the work diminishes as the personnel, equipment, and supplies of the different battalions create interference. On the basis of these saturation considerations, the following table presents estimates of the "desirable" number of engineer aviation battalions to be employed for the different types of construction.

- (1) The table below presents the composition of a typical engineer force required for the construction of USAF facilities in a theater of operations, including group, brigade, and command organizations. This, therefore, permits the computation of overhead personnel, in addition to direct personnel, required for aviation engineer construction work.*

	1	2	3	4
1	Type units	TOE No.	No. of units in typical theater	Remarks
2	Engr Avn Comd Hq & Hq Co ¹	200-1	1	1 per theater AF having more than 1 Engr Avn Brigade.
3	Engr Avn Brig Hq & Hq Co ¹	5-72	3	1 per 2-4 Engr Avn Gps. Augmented with administrative personnel when not under an Engr Avn Comd.
4	Engr Group Hq & Hq Co.....	5-412	9	1 per 2-4 Engr Avn Bns depending on deployment.
5	Engr Avn Bn.....	5-415	18	} ½ of battalions assigned are augmented
6	Engr Avn Bn (Augmented).....	5-415	9	
7	Engr Avn Depot Co.....	5-47	6	1 per Engr Avn Brigade.
8	Engr Avn Maint Co.....	5-157	9	1 per Engr Avn Gp.
9	Engr Avn Topo Co ²	5-400	1	1 per Engr Avn Comd.
10	Engr Avn Topo Det ³	5-400	3	1 per Engr Avn Brig.
11	Engr AF Hq Co ⁴	5-800-2	1	1 per Engr Avn Comd.
				Engineer Aviation Battalions Required to construct: ⁵
12	B-36 Base.....			4 Bns for 8 months.
13	B-29 Base.....			3 Bns for 5½ months or 2 Bns for 8 months.
14	Other Air Base.....			2-3 Bns for 3-4 months.
15	Air Depot.....			1 Bn for 6-8 months or 2 Bns for 3-4 months.

¹ Columns 8, 9, 10, 13, 19 of TOE.

² Column 15 of TOE to be incorporated in the new TOE of the Engr Avn Brigade.

³ Army troops are required to construct facilities off the base, such as roads, ports, pipelines, general hospitals, general depots, etc.

⁴ To be incorporated in the new TOE of the Engr Avn Comd.

⁵ Assumed minimum of 2 Air Force wings per air base.

- (2) The desirable number of battalions to perform the different construction jobs, as enumerated in the first table are based on judgment and experience. In point of fact, under actual

*Based on new TOE to be published.

operations, it is not unlikely that the number of battalions used will deviate from these desirable standards. This is because the availability of aviation engineer battalions and the requirements for them may not permit attainment of these standards.

Section III. ORDNANCE

262. Vehicle Losses

Estimated daily losses in front line divisions of general purpose vehicles destroyed and evacuated, number per 1,000 of actual vehicle strength:

	1	2	3	4
	General type of operations for the force as a whole	Destroyed	Require repair by unit maintenance section ¹	Require field or base maintenance
1				
2	Infantry division in attack of fortified position.....	27	27	15
3	Infantry division in attack of deliberately organized position..	16	15	11
4	Infantry division in attack of hastily organized position.....	10	10	9
5	Infantry division in covering, security force, retirement, or delaying action.....	5	5	7
6	Infantry division in defense of position.....	9	7	7
7	Infantry division in inactive situation ²	3	2	6
8	Infantry division in pursuit.....	5	5	7
9	Infantry division in assault of hostile shore.....	27	30	20
10	Infantry division in reserve.....	Negligible	³ 2	³ 1
11	Armored division in attack.....	16	15	11
12	Armored division in inactive situation ²	3	2	6
13	Armored division in pursuit or exploitation.....	5	8	10
14	Armored division in retirement or delaying action.....	5	5	7
15	Armored division in reserve.....	Negligible	³ 2	³ 1

¹ These quantities are in addition to the number in unit maintenance section each day for scheduled servicing.

² Forces in contact, neither side attacking.

³ These figures do not apply during rehabilitation.

Section IV. SIGNAL

263. Construction Factors

a. Estimated time required for line work operations.*

	Man-hours placing	Removing
Laying out and staking line open wire:		
150 foot span—mile.....	15	
Material distribution		
Lightweight metal poles—each.....	0.4	
Round wooden poles—each.....	.5	
Wire and accessory materials 150 foot span—4 pairs—mile.....	6.0	
Insulated wire and accessory materials—150 foot span—mile.....	2.0	
Lead cable and accessory materials—per reel.....	1.8	
Holes—pole:		
Dug by hand—per hole.....	3.0	
Dug by machine—per hole.....	.5	
Dug by blasting, hand drilling—per hole.....	5.0	
Holes—anchor:		
Dug by hand—4 x 4 log—each.....	3.0	
Dug by machine—log or plank—each.....	.7	
Dug by machine—patent—each.....	.8	
Dug by hand— $\frac{5}{8}$ inch rock—each.....	3.0	
Assembling hardware and placing crossarm—open wire:		
Lightweight metal—4 pins—each.....	.3	0.2
Round wood pole—8 pins—each.....	.5	.2
Setting poles (erecting, back filling, and tamping):		
Lightweight metal—each.....	.4	.3
20 foot round—each.....	2.0	1.0
30 foot round—each.....	2.5	1.2
Guying:		
Placing anchor and back-filling:		
Lightweight metal poles—each.....	.6	
Round pole log or plank—each.....	3.0	
Patent—each.....	2.0	
Placing and tensioning guying:		
W-145, 109 GS or similar—each.....	1.0	.6
Wire Messenger, 2.2M—each.....	1.5	.8
Wire Messenger, 6M or 10M—each.....	2.5	1.0
Installing line wire (placing, sagging, and tying in):		
1 pair—mile.....	25	13
4 pair—mile.....	40	18
Installing messenger wire:		
6 and 10M messenger—mile.....	36	30
16M messenger—mile.....	50	40
Placing lead covered cable on messenger:		
11 to 101 pair—mile.....	125	80
Above 101 pair—mile.....	164	116
Placing insulated wire on existing pole line—mile.....	12	7
Ground surface construction:		
Spiral 4—mile ¹	2.6	2.6
Wire W-143 or similar—mile ¹	2.2	2.0
See footnotes at end of table.		

*Time indicated is maximum for any operation.

	Man-hours placing	Removing
Buried construction (using cable plow LC-61): ¹		
Spiral 4:		
1 cable—mile.....	8.5	3
2 cables, same trench—mile.....	12.0	5
Jute covered, tape armored—mile.....	45	65
Wire W-143:		
1 pair—mile.....	8.5	3
2 pairs, same trench—mile.....	12.0	5
Constructing overhead crossing for insulated wire—each (installing messenger and rings, pulling in wire).....	5.2	

¹ For surveying, staking line, testing sections, and policing add 12 man-hours per mile for spiral four and 6 man-hours per mile for wire W-143.

² Does not cover operations in jungle, Arctic, or desert areas.

b. Characteristics of round telephone poles (American Standard).

Class	1	2	3	4	5	6	7
Minimum top circum- ference (inches).	27	25	23	21	19	17	15
Transverse breaking loads (pounds).	4,500	3,700	3,000	2,400	1,900	1,500	1,200
Type	Length	Approximate average weight (pounds)					
Western Cedar,	20-feet	700	600	500	400	300	200
		720	600	540	350	300	190
Northern Cedar, Creosoted	25-feet	635	555	479	418	353	259
		850	720	600	480	400	250
Pine.	25-feet	1,020	780	600	515	420	250
		898	808	686	602	508	362
	30-feet	1,000	850	730	610	500	420
		1,320	1,170	870	630	520	420
	35-feet	1,241	1,076	921	780	672	489
		1,200	1,000	850	750	650	470
		1,620	1,380	1,060	820	720	450
		1,603	1,410	1,213	996	865	733
							616

Northern and Western Cedars are furnished butt treated; pine is treated full length. An estimate of the shipping space required for poles:

$$\frac{\text{Average weight (pounds)} \times \text{constant}}{40} = \text{Measurement tons}$$

Values of the constant are:

Cedars=0.052

Pine=0.026

c. Comparison of the means to obtain telephone channels—100 miles.

	Construction time in man-days ¹	Ship tons	Measure- ment tons
Radio relay, 4-channel ²	35	10	26
Radio relay, 12-channel ²	60	53	279
Radio relay, 24-channel ²	60	53	279
CF carrier on spiral—4 (buried):			
Total 4 channels.....	285	50	75
CF carrier on spiral—4 (suspended):			
Total 4 channels.....	440	50	75
O Carrier on open wire (light weight metal poles and crossarms) 2 sys- tems:			
Total 16 channels ⁴	105	187	192
C Carrier on Standard open wire (30-foot poles spaced 150 feet)—4 sys- tems:			
Total 16 channels ⁴	10,060	6,204	9,846
O Carrier on standard open wire (30-foot poles spaced 150 feet):			
Total 32 channels ⁴	10,120	6,204	9,846

¹ Does not apply to operations in jungle, Arctic, or desert.

² Repeater spacing, approximately 25 miles.

³ Includes site survey and selection, travel time, equipment and antenna installation time, etc. (Antennas are field type, not steel towers.)

⁴ Repeater spacing, approximately 100 miles.

⁵ Construction time is based on signal construction battalion day consisting of 500-man-days and completion of 5 miles of O. W. per day.

d. Commercial type telephone switchboard capacity—position comparison.

<i>Local switchboard capacity—lines</i>	<i>Positions</i>
100.....	1 or 2.
400.....	7 basic.
600.....	10 basic.
800.....	11 basic.
1,000.....	14 basic.
1,200.....	16 basic.
1,600.....	20 basic.
2,000.....	27 basic.
2,800.....	40 basic.
3,600.....	60 basic.
<i>Toll switchboard capacity—lines</i>	
100.....	15.
200.....	25.
300.....	34.
400.....	40.

e. LOCAL (Common Battery Manual)..... Call Handling Time and Traffic Distribution.

(1) *Call handling time.*

One operator handles 150 calls per operator hour.

Two operators handle 200 calls per operator hour.

Three operators handle 220 calls per operator hour.

Four operators handle 225 calls per operator hour.

Five or more operators handle 230 calls per operator hour.

(2) *Distribution of traffic* (average situation).

	<i>Percent</i>
Local calls.....	40
Outgoing trunk calls.....	30
Incoming trunk calls.....	30

 100

f. TOLL (Common Battery Manual) Call Handling Time and Traffic Distribution.

(1) *Call handling time.*

One operator handles 20 calls per operator hour.

Two operators handle 25 calls per operator hour.

Three operators handle 30 calls per operator hour.

Four operators handle 35 calls per operator hour.

Five operators handle 40 calls per operator hour.

(2) *Distribution of traffic* (average situation).

	<i>Percent</i>
Outward.....	55
Inward.....	30
Through (Swbd).....	15

 100

g. Normal Telephone Instrument Requirements:

(1) One per general officer.

(2) One per two field grade officers.

(3) One per four company grade officers.

(4) One per 50 or 100 enlisted men, depending on whether troop basis is on TOE basis or personnel are operating as part of a large headquarters staff.

h. Building Space Requirements.

C. B. Manual Telephone Switchboard (Fixed Plant)

<i>Line capacity</i>	<i>Switch-board positions</i>	<i>Space Requirements—square feet</i>
100.....	1	250
100.....	2	275
200.....	2	300
200.....	4	500
600.....	10	1, 380
800.....	11	1, 520
1,000.....	14	1, 900
1,200.....	16	2, 280
1,600.....	22	2, 764
2,000.....	27	3, 400
2,800.....	40	4, 760
Fixed Communication Center:		
Small.....		950
Medium.....		1, 900
Large.....		3, 000
Fixed Radio Transmitter Station:		
Small.....		2, 300
Medium.....		4, 425
Large.....		5, 500
Fixed Radio Receiver Station:		
Small.....		1, 550
Medium.....		3, 600
Large.....		4, 450
Antenna Field:*		
Transmitter:		<i>Acres</i>
Small (2-6 antennas).....		6 to 30.
Medium (9 antennas).....		35 to 100.
Large (20 antennas).....		100 to 400.
Receiver:		
Small (2 antennas).....		6.
Medium (20 antennas).....		100 to 300.
Large (35 antennas).....		200 to 600.

*Space is based on average conditions existing, however, depending on type antennas, equipment used etc., location, and terrain, space requirements may vary.

CHAPTER 9

LOGISTICS—MANAGEMENT

Section I. GENERAL

264. General

Preceding chapters on logistics have presented detailed data applicable to all branches of logistical planning. This chapter summarizes these data in the form of general logistical planning factors that will be found useful to staff officers at division and higher levels. It should be noted that these factors apply to *average* conditions and situations. Specific situations may require widely different factors. They should be used only as a first approximation in logistical planning or as "rule of thumb" checks against the calculations of technical planners.

265. Organizational Factors—Theater Slices

a. Division Slices.

Composition of slice by assignment of troops		Percent of slice		Composition of slice by location of troops	
Assignment	Troops			Troops	Location
Basic division.....	16,850	39	50	21,626	Division area.
Corps and army Combat.....	9,050	21			
Service.....	6,600	15	25	10,812	Corps and army rear areas.
Communications zone and theater over-head.	10,750	24	25	10,812	Communications zone.
Total.....	43,250	100	100	43,250	All.

b. Air Wing Slices.

Composition of slice by assignment of troops		Percent of slice		Composition of slice by location of troops	
Air Force combat organization.....	2,550	36			Division area.
Miscellaneous AF support units.....	3,450	50			Corps and army rear areas.
Army communications zone troops*.....	1,000	14	100	7,000	Communications zone.
Total.....	7,000	100	100	7,000	All.

*Army troops required within the theater because of the presence of Air Force elements requiring army administrative support.

c. Detailed figures on slices appear in paragraphs 47 through 53.

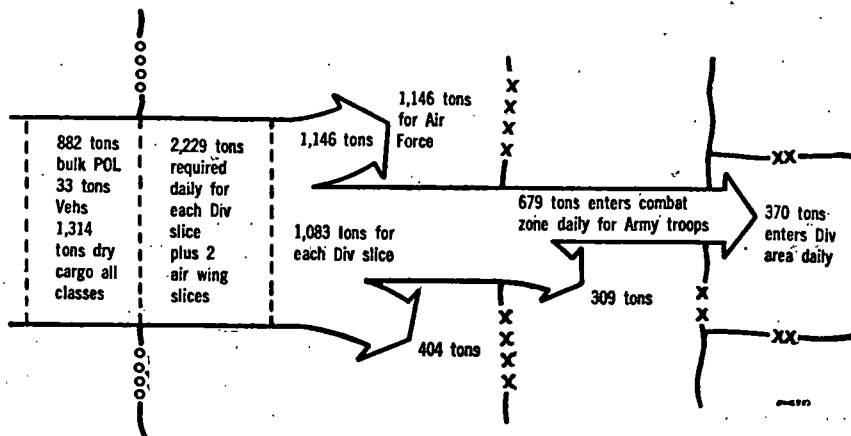
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Section II. LOGISTICAL FACTORS

266. Supply Factors

These factors are for use as broad initial planning factors. They do not include tonnages involved in buildup of theater reserves.

a. Maintenance, short tons per day, for each division slice plus two air wing slices.



b. Maintenance, pounds per man per day.

	Consumed per man in theater (Army plus Air)	Consumed by Army in theater, per Army man in theater	Consumed by Army in combat zone, per Army man in combat zone	Consumed by Army in division areas, per Army man in such areas
Bulk POL.....	31	10	10	5
Vehicles.....	1(-)	1(-)	1	1(+)
Dry cargo.....	46	39	31	31(-)
Total.....	78	50(-)	42	37

c. Initial equipment plus 30 days' maintenance.

	Measurement tons per man in the theater (Army plus Air)	Short tons per man in the theater (Army plus Air)	Long tons per man in the theater (Army plus Air)
Initial equipment.....	4.0	1.50	1.33
30 days' maintenance dry cargo.....	1.0	.68	.60
30 days' maintenance bulk POL.....	.4	.28	.25
Total.....	5.4	2.46	2.18

¹ In World War II, 0.8 of this figure was shipped from zone of interior and remainder procured locally.

² Bulk petroleum normally is not expressed in measurement tons. This figure is provided for the purpose of comparison with dry cargo. Bulk petroleum represents 90 percent of all petroleum shipped to the theater. The remaining 10 percent is shipped packaged and is included in dry cargo.

267. Evacuation and Hospitalization Factors

Kind of hospitalization	Quantity required
1. Mobile hospital units:	
Evac, Smbi.....	1 per div.
Evac, (750 bed).....	1 per corps.
Surg, Mbi.....	1 per div.
2. Fixed hospital beds in the theater of operations (general and station hospitals).	7 percent of theater of operations strength.

268. Transportation Factors

a. Capacities of Transportation Mediums.

Mediums		Short tons per day	Long tons per day	Adequate to maintain
Highways (average) (see par. 218).	Gravel.....	1,000	890	2 divisions.
	Medium condition.....	2,500	2,230	Corps of 4 divisions.
	First class.....	8,000	7,140	Field army of 8-12 divisions.
Railways each way.....	Single track.....	4,000	3,570	2 corps totaling 5-8 divisions.
	Double track.....	12,000	10,700	Field army of 12-18 divisions.
Gasoline pipeline.....	6-inch.....	1,842	1,645	3 corps totaling not more than 12 divisions.
	4-inch.....	883	788	
Discharge rate.....	Average cargo ship.....	720	633	
Across beaches.....	Per 1,000 yards of beach.....	1,680	1,500	
Capacities of average cargo ship.....		10,000 measurement tons or 5,000 long tons of Army cargo.*		
Capacities of average train in theater of operations...		1,000 troops or 400 short tons of cargo.		

*See paragraph 240n.

b. Transportation Requirements of the Infantry Division.

Type	Requirement		
Highway	261 trucks or 5 Trans Light Trk companies in addition to organic transport.		
Air	Approximately 1,744 C-119 or C-123 type aircraft and 339 C-124 type aircraft are required to airland an infantry division. In addition to weapons and vehicles, this combination provides for the lift of 275 tons of supplies and miscellaneous equipment. These aircraft requirements are based on the substitution of light tanks for medium tanks.		
Amphibious assault.	Average strength of an <i>assault division</i> , including shore party and other attached and supporting elements, is 25,000 men with 5,000 vehicles. If 75 percent of the vehicles of the infantry division and attached and supporting elements are loaded out with the division in assault shipping, the requirements in assault shipping for reinforced division in an amphibious assault are:		
	Type	Extended voyage (10 days)	Short voyage (2-3 days)
	APA (Auxiliary transport, attack)	15	9
	AKA (Cargo ship, attack)	6	6
	LST (Landing ship, tank)	12	36
	LSM (Landing ship, medium)	12	12
	LSD (Landing ship, dock)	3	3

269. Service Factors

a. Service Troop Factors. Service troops equal 43 percent of division slice; 60 percent of service units are in communications zone, 40 percent in combat zone.

b. Equipment Factors. One vehicle for five to six men in a balanced force.

CHAPTER 10

MISCELLANEOUS

Section I. CONVERSION FACTORS

270. Weight

	1	2	3	4	5	6
1	Unit	Long tons	Metric tons	Short tons	Kilo-grams	Pounds
2	1 long ton =		1.0160	1.1200	1,016	2,240
3	1 metric ton =	0.9842		1.1023	1,000	2,204.6
4	1 short ton =	.8929	.9072		907.2	2,000
5	1 kilogram =					2.2046

271. Speed

	1	2	3	4	5	6	7	8
1	Unit	Knots	Statute miles per hour	Kilometers per hour	Feet per minute	Feet per second	Meters per minute	Meters per second
2	1 knot =		1.1516	1.8532	101.34	1.6890	30.89	0.5148
3	1 mile per hr =	0.8684		1.6093	88.00	1.4667	26.82	.4470
4	1 km per hr =	.5396	.6214		54.68	.9113	16.67	.2778

*1 knot=1 nautical mile per hour.

272. Power

	1	2	3	4	5	6
1	Unit	Kilo-watts	Horse power	BTU* per min	Ft lb per sec	Ft lb per min
2	1 kilowatt =		1.3410	56.88	737.6	44,250
3	1 horsepower =	0.7457		42.42	550.0	33,000
4	1 btu* per min =	.01758	.02358		12.968	778.1

*1 BTU or British thermal unit is the quantity of heat required to raise the temperature of 1 pound of water 1° Fahrenheit.

273. Angular Conversions

	1	2	3	4	5
1	Unit	Radians	Degrees	Mils	Minutes
2	1 radian =		57.30	1,018.6	
3	1 degree =	0.17453		17.778	60
4	1 mil =		.05625		3.375

NOTE

360°=2 π Radians=6,400 mils.

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274. Trigonometric Functions

READ DOWN					
Degrees	Sin	Cos	Tan	Cot	
0	0.0000	1.0000	0.0000	∞	90
1	.0175	.9998	.0175	57.2900	89
2	.0349	.9994	.0349	28.6363	88
3	.0523	.9986	.0524	19.0811	87
4	.0698	.9976	.0699	14.3007	86
5	.0872	.9962	.0875	11.4301	85
6	.1045	.9945	.1051	9.5144	84
7	.1219	.9925	.1228	8.1443	83
8	.1392	.9903	.1405	7.1154	82
9	.1564	.9877	.1584	6.3138	81
10	.1736	.9848	.1763	5.6713	80
11	.1908	.9816	.1944	5.1446	79
12	.2079	.9781	.2126	4.7046	78
13	.2250	.9744	.2309	4.3315	77
14	.2419	.9703	.2493	4.0108	76
15	.2588	.9659	.2679	3.7321	75
16	.2756	.9613	.2867	3.4874	74
17	.2924	.9563	.3057	3.2709	73
18	.3090	.9511	.3249	3.0777	72
19	.3256	.9455	.3443	2.9042	71
20	.3420	.9397	.3640	2.7475	70
21	.3584	.9336	.3839	2.6051	69
22	.3746	.9272	.4040	2.4751	68
23	.3907	.9205	.4245	2.3559	67
24	.4067	.9135	.4452	2.2460	66
25	.4226	.9063	.4663	2.1445	65
26	.4384	.8988	.4877	2.0503	64
27	.4540	.8910	.5095	1.9626	63
28	.4695	.8829	.5317	1.8807	62
29	.4848	.8746	.5543	1.8040	61
30	.5000	.8660	.5774	1.7321	60
31	.5150	.8572	.6009	1.6643	59
32	.5299	.8480	.6249	1.6003	58
33	.5446	.8387	.6494	1.5399	57
34	.5592	.8290	.6745	1.4826	56
35	.5736	.8192	.7002	1.4281	55
36	.5878	.8090	.7265	1.3746	54
37	.6018	.7986	.7536	1.3270	53
38	.6157	.7880	.7813	1.2799	52
39	.6293	.7771	.8098	1.2349	51
40	.6428	.7660	.8391	1.1918	50
41	.6561	.7547	.8693	1.1504	49
42	.6691	.7431	.9004	1.1106	48
43	.6820	.7314	.9325	1.0724	47
44	.6947	.7193	.9657	1.0355	46
45	.7071	.7071	1.0000	1.0000	45
	Cos	Sin	Cot	Tan	Degrees
READ UP					

275. Linear Measure

	1	2	3	4	5	6	7	8	9	10	11
1	Unit	Nautical miles	Statute miles	Kilo-meters	Cable lengths	Fathoms	Meters	Yards	Feet	Inches	Centi-meters
2	1 nautical mile=.....	X	1.1516	1.8532	8.445	1,013.4	1,853.2	2,026.8	6,080.27	72,963	185,325
3	1 statute mile=.....	0.8684	X	1.6093	7.333	880	1,609.3	1,760	5,280	63,360	160,933
4	1 kilometer=.....	.5396	.6214	X	4.557	546.8	1,000.0	1,093.6	3,281	39,370	100,000
5	1 cable length=.....	.1184	.1364	.2195	X	120	219.5	240	720	8,640	21,945
6	1 fathom=.....				X		1.829	2	6	72	182.88
7	1 meter=.....					.5468	X	1.0936	3.281	39.37	100
8	1 yard=.....					.5000	.9144	X	3	36	91.44
9	1 foot=.....					.1667	.3048	.3333	X	12	30.48
10	1 inch=.....								.0833	X	2.540
11	1 centimeter=.....								.0328	.3937	X

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276. Surface

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1	2	3	4	5	6	7	8	9
Unit	Square miles	Square kilometers	Hectares	Acres	Square rods	Square meters	Square yards	Square feet
1 square mile=.....		2.59	259	640	102,400	2,589,945	3,097,600	
1 square kilometer=.....	0.3861		100	247.1	39,537	1,000,000	1,196,010	
1 hectare.....		.0100		2.471	395.4	10,000	11,960	107,641
1 acre=.....			.4047		160	4,047	4,840	43,560
1 square rod=.....						25.29	30.25	272.25
1 square meter=.....					.03954		1.1960	10.764
1 square yard=.....					.03306	.8361		9.000

277. Volume

	1	2	3	4	5	6
1	Unit	Cubic feet	Imperial gallons	U. S. gallons	Liters	Quarts
2	Cubic foot =		6. 229	7. 481	28. 32	29. 92
3	1 Imperial gallon =	0. 16054		1. 2010	4. 546	4. 804
4	1 U. S. gallon =	. 13368	. 8327		3. 785	4. 000
5	1 liter =	. 03532	. 2201	. 2642		1. 0567
6	1 measurement ton =	40.	.....	.....	.....	.....

Section II. PHYSICAL CONSTANTS**278. Speed of Sound**

	1	2	3	4	5	6	7	8
1	Unit	In air (at degrees F.)					In water	
		10°	0°	30°	70°	100°	Fresh	Salt
2	Feet per sec =	1, 039	1, 050	1, 083	1, 127	1, 171	4, 700	4, 752
3	Miles per hr =	708	716	738	768	797	3, 205	3, 246

279. Speed of Light

The speed of light is 186,324 miles per second.

280. Acceleration Due to Gravity

Acceleration due to gravity is 32.2 feet per second per second.

281. Atmospheric Pressure

Atmospheric pressure is 14.7 pounds per square inch. This is equal to the pressure exerted by a column of water 33.9 feet high, which is the theoretical maximum height to which water may be drawn by suction.

282. Circumference of the Earth at the Equator

The circumference of the earth at the equator is 24,902 miles.

283. Time Between Moons

Time between moons is 29 days, 12 hours, 44 minutes.

APPENDIX

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FM 5-15	Field Fortifications.
FM 5-35	Engineer Reference and Logistical Data.
FM 7-24	Communications in Infantry and Airborne Infantry Divisions.
FM 9-6	Ordnance Ammunition Service in the Field.
FM 11-22	Signal Operations in the Corps and Army.
FM 11-40	Signal Photography.
FM 17-70	Signal Communications in the Armored Division.
FM 20-32	Employment of land mines.
FM 21-5	Military Training.
FM 21-8	Military Training Aids.
FM 21-25	Elementary Map and Aerial Photograph Reading.
FM 21-26	Map Reading.
FM 21-30	Military Symbols.
FM 24-16	(Classified).
FM 24-17	Communication Center Operation.
FM 24-18	Field Radio Techniques.
FM 24-20	Field Wire Technique.
FM 30-5	Combat Intelligence.
FM 55-130	The Harbor Craft Company.
FM 57-20	Airborne Techniques for Divisional Units.
FM 57-30	Airborne Operations.
FM 100-5	Field Service Regulations, Operations.
FM 100-10	Field Service Regulations, Administration.
FM 100-11	Signal Communications Doctrine.
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TM 5-245	Map Reproduction in the Field.
TM 5-248	Foreign Maps.
TM 5-277	Panel Bridge, Bailey Type, M2.

APPENDIX

- TM 5-280 Construction in the Theater of Operations.
- TM 5-283 AFM 90-5, Utilities.
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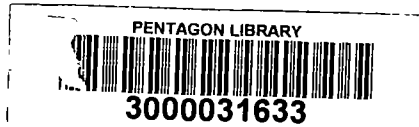
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